

# MONITORING PROGRAM ANNUAL REPORT

JANUARY - DECEMBER 2001

## ANCHORAGE WATER AND WASTEWATER UTILITY JOHN M. ASPLUND WATER POLLUTION CONTROL FACILITY AT POINT WORONZOF



Prepared for:



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Anchorage Water & Wastewater Utility  
Anchorage, Alaska

Prepared by:



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February 2002

Satellite image courtesy of: NASA/GSFC/MITI/ERSDAC/JAROS and the U.S./Japan ASTER Science Team.  
View of Anchorage and Cook Inlet as seen on May 12, 2000 by the Advanced Spaceborne Thermal Emission  
and Reflection Radiometer (ASTER) orbiting at 705 km on board NASA's Terra satellite.

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**NPDES Permit AK-002255-1**

*Prepared for:*



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## **PREFACE**

This document is the Monitoring Program Annual Report required for submittal to the Environmental Protection Agency by NPDES Permit AK-002255-1 for discharge from the John M. Asplund Water Pollution Control Facility, operated by the Municipality of Anchorage at Point Woronzof. The NPDES permit incorporates provisions necessitated by a 301(h) waiver from the requirements of secondary treatment.

The elements of the monitoring program are:

- Influent, Effluent, and Sludge Monitoring
  - In-Plant Sampling
  - Toxic Pollutant and Pesticide Sampling
  - Pretreatment Monitoring
  - Whole Effluent Toxicity Monitoring
- Receiving Water Quality Monitoring
  - Plume Dispersion
  - Intertidal Zone Bacteria
- Sediment and Bioaccumulation Monitoring
  - Sediment Analyses
  - Bioaccumulation Analyses

During 2001, the program consisted of sampling the influent, effluent, and sludge twice for toxic pollutants and pesticides and one receiving water quality sampling. In addition, the Municipality of Anchorage conducted the required self-monitoring program for the influent, effluent, and sludge. No sediment or bioaccumulation sampling was conducted during 2001.

This annual report provides information concerning the second year of the monitoring program performed to meet the requirements as set forth in the NPDES permit that became effective on 2 August 2000. The report covers the period of 1 January through 31 December 2001.



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### **APPENDIX A      Toxic Pollutant and Pesticide Monitoring Data, June Sampling**

- A1      Anchorage Water and Wastewater Utility  
         Metals, Oil & Grease and Cyanide
- A2      ToxScan  
         Metals, Pesticides, Hydrocarbons
- A3      Northern Testing Laboratories, Inc.  
         Priority Pollutants
- A4      Solar Environmental Services  
         Asbestos
- A5      Severn Trent Laboratories  
         Dioxin
- A6      Northern Testing Laboratories, Inc.  
         Enterococci

### **APPENDIX B      Toxic Pollutant and Pesticide Monitoring Data, September Sampling**

- B1      Anchorage Water and Wastewater Utility  
         Metals, Oil & Grease and Cyanide
- B2      ToxScan  
         Metals, Pesticides, Hydrocarbons
- B3      Northern Testing Laboratories, Inc.  
         Priority Pollutants
- B4      Solar Environmental Services  
         Asbestos Data
- B5      Severn Trent Laboratories  
         Dioxin
- B6      Northern Testing Laboratories, Inc.  
         Enterococci

### **APPENDIX C      Whole Effluent Toxicity Testing**

- C1      ToxScan  
         First Quarter Test
- C2      ToxScan  
         Second Quarter Test
- C3      ToxScan  
         Third Quarter Test
- C4      ToxScan  
         Fourth Quarter Test

## **APPENDICES, CONTINUED (BOUND SEPARATELY)**

APPENDIX D	Receiving Water Quality Monitoring
D1	ToxScan Hydrocarbons, TSS and Cyanide
D2	Texas A&M GERG PAHs
D3	Battelle Trace Metals
D4	Northern Testing Laboratories, Inc. Intertidal Bacteria, TRC and Color
D5	Kinnetic Laboratories, Inc. Salinity, Dissolved Oxygen, and Turbidity
D6	Hydrographic Data Profiles Kinnetic Laboratories, Inc.
D7	Field Data Sheets Kinnetic Laboratories, Inc.

## **SUMMARY**

### **PURPOSE**

This report is submitted in response to requirements of the U.S. Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation (ADEC) as outlined in the National Pollutant Discharge Elimination System (NPDES) Permit AK-002255-1 that was signed on 30 June 2000 and became effective on 2 August 2000. This permit authorizes discharge of effluent from the John M. Asplund Water Pollution Control Facility (Asplund WPCF). Wastewater from the Municipality of Anchorage (MOA) is treated at this facility before discharge to the receiving waters of Knik Arm in Cook Inlet, Alaska. The NPDES permit incorporates the requirements necessitated by a 301(h) waiver from secondary treatment and is in compliance with provisions of the Federal Water Pollution Control Act as amended by the Clean Water Act (CWA, 33 U.S.C. §1251 et seq.) and the Water Quality Act of 1987, P.L. 100-4.

### **HISTORY**

In September 1979, the MOA submitted to the EPA a 301(h) secondary treatment waiver application proposing an improved discharge which eliminated chlorination and required the addition of both a 610-meter (m) extension and a 305-m diffuser to the Asplund WPCF outfall. The outfall extension was intended to move the point of discharge beyond the influence of a gyre that was reported to exist off Point Woronzof on a flood tide which was presumed to carry effluent toward shore, causing bacterial contamination of the shoreline.

Further studies were subsequently undertaken to derive design criteria for the outfall improvements. The central issue was to evaluate outfall design alternatives and the chlorination/no chlorination option in relation to a system of eddies that occur on the flood tide. These studies were completed and presented as an Amendment to the Wastewater Facilities Plan for Anchorage, Alaska (CH2M Hill et al., 1985). This amended plan recommended the use of the existing 245-m outfall with the addition of a three-nozzle diffuser. It was shown that chlorination would be required to meet bacterial standards even with an extended outfall and diffuser. Because the same water quality standards could be met by chlorinating and installing an improved diffuser at the end of the existing outfall, there was no need to extend the outfall.

Concurrent with the studies to amend the facilities plan, a revised 301(h) waiver application was submitted to the EPA. After extensive EPA review, public comment, and hearings, the Final Permit Decision was issued and the five-year NPDES permit became effective 16 October 1985 (EPA, 1985a). The permit specifies the required monitoring program. As required by this permit, a multi-port diffuser was installed in August 1987 prior to the second year of receiving water sampling. Fourteen years of monitoring were performed under the initial NPDES permit.

The MOA submitted an application to renew the 301(h) waiver from secondary treatment in 1990. A more recent application was submitted in 1998 with additional information provided to EPA in 1999. A draft NPDES permit that incorporated the 301(h) waiver was issued in 1999 for public comment. The renewed permit was signed by EPA on 30 June 2000 to become effective on 2 August 2000. This five-year permit expires on 2 August 2005.

## **RECEIVING WATER ENVIRONMENT**

The Asplund WPCF discharges into Knik Arm, a unique body of estuarine water with extremely high tidal fluctuations (up to 11.6 meters [m] with a mean range of 7.89 m at Anchorage; NOAA/NOS, 1995). These fluctuations produce extensive tidal flats, swift tidal currents of 4 - 5 knots, and intense mixing within the Inlet. The water is almost a slurry because of the naturally high suspended sediment concentrations of up to 2500 milligrams/liter (mg/L). This sediment originates from glacial melt waters discharging into Cook Inlet.

Large temperature extremes occur between summer and winter. In the winter, ice can reach thicknesses of 1 - 2 m and consists of broken pieces due to the large tides and currents. Other important factors are the large volume of saline water present in Cook Inlet and mixing by tidal turbulence which allows this volume to be effective in wastewater dilution and assimilation.

## **MONITORING OBJECTIVES**

The monitoring that was conducted during 2001 consisted of two main components: (1) in-plant monitoring of influent, effluent, and sludge, including whole effluent toxicity testing; and (2) receiving water quality monitoring in the vicinity of the discharge and at a control site across Knik Arm. Objectives of the 2001 program are summarized as follows:

### **2001 MONITORING OBJECTIVES**

#### **Influent, Effluent, and Sludge Monitoring**

- determine compliance with the NPDES permit and State of Alaska water quality criteria
- determine effectiveness of the industrial pretreatment program
- aid in assessing the water quality at the discharge point
- characterize toxic substances
- help monitor plant performance
- determine compliance with the regulatory criteria of Section 301(h) of the CWA
- provide data for evaluation of permit re-issuance

#### **Water Quality**

- determine compliance with the NPDES permit and State of Alaska water quality criteria
- aid in assessing the water quality at the discharge point
- determine compliance with the regulatory criteria of Section 301(h) for the CWA
- determine the level of bacterial contamination in nearshore waters
- provide data for evaluation of permit re-issuance

## **MONITORING RESULTS**

As part of its self-monitoring program, the Anchorage Water and Wastewater Utility (AWWU) conducted daily, weekly, and monthly sampling of influent, effluent, and sludge, depending on the parameter measured. In addition, monitoring for toxic pollutants and pesticides was conducted twice during 2001; once in June 2001 and once in September 2001. Whole effluent toxicity testing was conducted quarterly during 2001. Water quality monitoring near the discharge was conducted once during June 2001. The following summarizes results from this year of monitoring based on the permit requirements:

### **2001 MONITORING RESULTS**

#### **Influent, Effluent, and Sludge**

- Met permit objectives and requirements and Alaska State water quality standards with the exception of a single permit exceedence for only one parameter (total residual chlorine). Results from parameters of particular concern are summarized below, including the single permit exceedence as noted.
- Fecal coliform did not exceed the monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL during any month". It should be noted that the current permit actually includes a level that is 100 times higher (2600 FC MPN/mL), but this is believed to be a typographical error in the final permit. In addition, the maximum geometric mean of 850 FC MPN/100 mL was never exceeded.
- Total aromatic hydrocarbon concentrations and total aqueous hydrocarbon concentrations measured in the effluent were below the maximum allowable effluent concentration (MAEC).
- Cyanide and metals concentrations in the effluent never exceeded their MAECs at any time during any of the 2001 sampling events.
- MOA's self-monitoring of pH, biochemical oxygen demand (BOD<sub>5</sub>), and total suspended solids (TSS) showed compliance with permit effluent limitations. TSS and BOD<sub>5</sub> were well within the daily, weekly, and monthly criteria for the entire reporting period. The percent removal rate for both TSS and BOD<sub>5</sub> were well within required limits.
- MOA's self-monitoring of total residual chlorine (TRC) showed that the daily maximum for TRC in the effluent was exceeded once in December 2001 during the installation of a new chlorine feed control system. Permit limitations for this parameter were met during the rest of the year.
- Concentrations of toxic pollutants and pesticides, including metals and cyanide, in influent and effluent were within the established range or lower than values from a national study of secondary treatment plants.
- Toxic pollutant sludge concentrations were within the established range or lower than values from a national study of secondary treatment plants. Concentrations of metals in sludge were well below allowable 40 CFR Part 503 limitations.

- Whole effluent toxicity testing conducted quarterly during 2001 met the permit limitations for chronic toxicity.

## **Water Quality**

- Little variation among stations was observed for most parameters.
- Receiving water and intertidal fecal coliform concentrations met the most restrictive State water quality criteria median of 14 MPN/100 mL for "harvesting for consumption of raw mollusks or other raw aquatic life". The criterion of the geometric mean not exceeding 20 MPN/100 mL was also met. Receiving water samples met the criterion of not more than 10 % of the samples exceeding 40 MPN 100/mL; however, intertidal bacterial samples, taken separately, failed to meet this criterion with 12.5 % exceeding 40 MPN 100/mL. Local creeks again showed elevated fecal coliform concentrations and most likely contributed to the higher values seen at the intertidal stations relative to the effluent or the receiving water stations.
- Fecal coliform concentrations were not statistically different within the zone of initial dilution (ZID), at the ZID boundary, and at the nearfield stations as compared to the control stations. Higher values seen at a few stations could not be directly attributed only to the Asplund WPCF discharge as local creeks exhibited fecal coliform concentrations higher than most of the water quality and intertidal stations.
- Supplemental receiving water quality samples obtained as part of the plume dispersion monitoring indicated that levels of dissolved metals at all receiving water locations were below the State site-specific water quality standards. Significant differences between the outfall and control stations were seen in dissolved cadmium, copper, lead, and silver. For dissolved cadmium, copper, and silver, these differences were believed to be the result of the relatively high concentrations in the effluent compared to the receiving water; however, concentrations of these metals still met water quality standards. Total recoverable metals were elevated compared to the dissolved, as expected, and this was attributed to high suspended sediment loads. No significant differences between the outfall and control stations were found for total recoverable metals. All receiving water cyanide concentrations were below the detection limit.
- Total aqueous hydrocarbons and total aromatic hydrocarbons met the State's water quality standards at all stations. No significant differences were found between concentrations at the control and outfall stations for these hydrocarbons.
- Turbidity and TRC met the State water quality criteria at all stations. Color exceeded the State standard at several stations, but this was not attributed to the outfall.

## **CONCLUSIONS**

Results from this year of the monitoring program confirm previous studies, data in the 301(h) waiver application, and the decision by the EPA to reissue the permit. The Asplund WPCF is operating within regulatory requirements and with no significant impacts to the marine environment.

## **1.0 INTRODUCTION**

### **1.1 REGULATORY/ENVIRONMENTAL BACKGROUND**

The monitoring program is designed to meet the requirements of the National Pollutant Discharge Elimination System (NPDES) Permit AK-002255-1 which authorizes discharge of municipal effluent into the Knik Arm of Cook Inlet receiving waters from the John M. Asplund Water Pollution Control Facility (Asplund WPCF), operated by the Municipality of Anchorage (MOA), Figure 1. The NPDES permit, which became effective on 2 August 2000, incorporates the requirements necessitated by a 301(h) secondary treatment waiver and is in compliance with provisions of the Federal Water Pollution Control Act as amended by the Clean Water Act (33 U.S.C. §1251 et seq.) and the Water Quality Act of 1987, P.L. 100-4.

#### **1.1.1 Regulatory Background**

In 1972, while the Asplund WPCF and outfall were being built for the MOA, the Federal Water Pollution Control Act (FWPCA) was amended to establish two phases of effluent limitations applicable to all Publicly Owned Treatment Works (POTWs). Under 301(b), POTWs were required to achieve secondary treatment of effluent by 1 July 1977 and the "best practicable waste treatment technology" by July 1983.

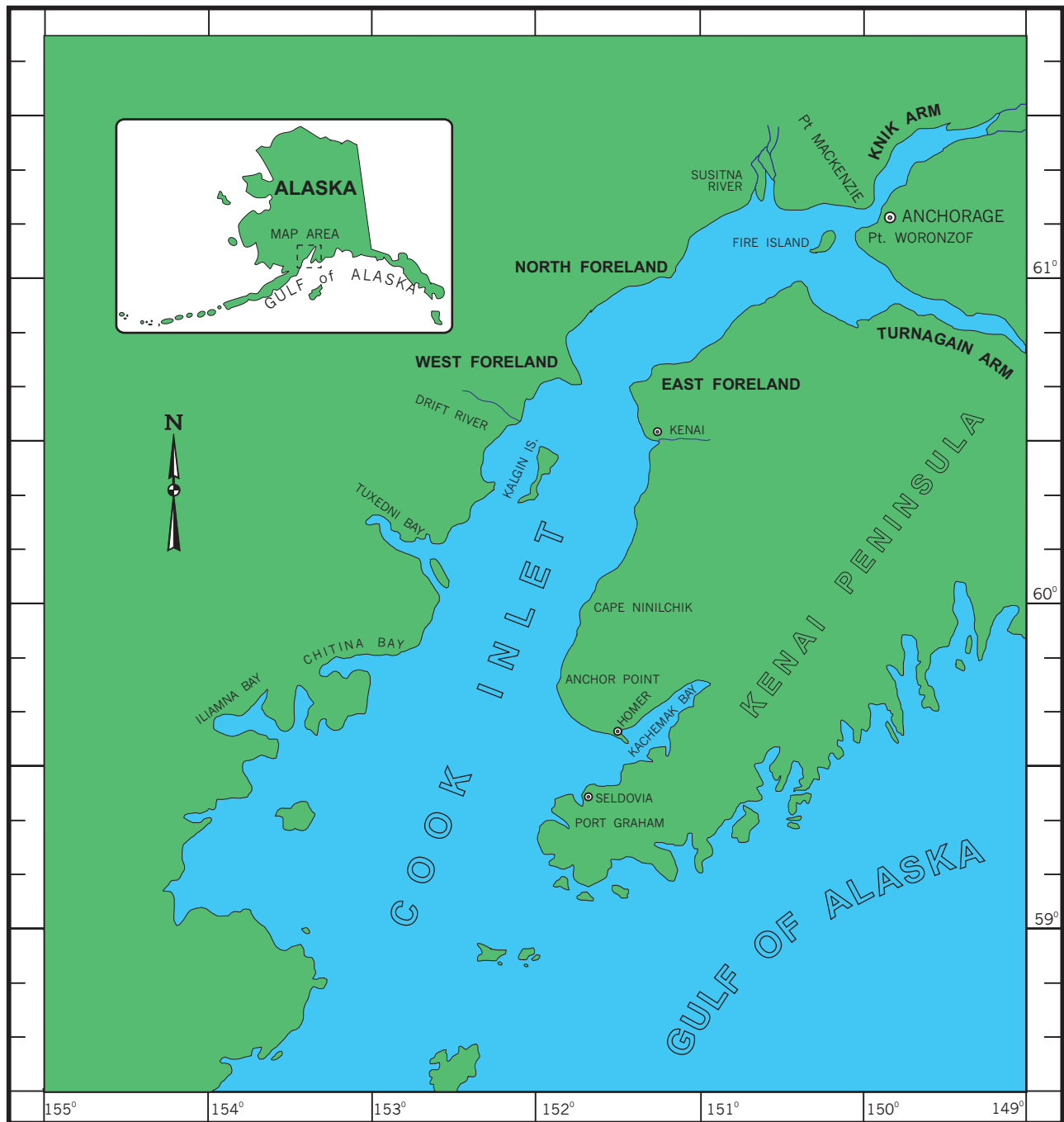
Congress again amended the FWPCA in 1977. Section 301(h) was added, providing that the Administrator of the EPA, upon application from a POTW and with the concurrence of the State, might issue an NPDES permit waiving the requirements of Section 301(b). On 15 June 1979, EPA promulgated the regulations regarding the issuance of this waiver of secondary treatment to an applicant discharging into certain ocean and estuarine waters and demonstrating compliance with the 301(h) criteria.

In September 1979, the MOA forwarded to the EPA a 301(h) waiver application proposing an improved discharge which eliminated chlorination and required the addition of both an extension and diffuser to the Asplund WPCF outfall. Earlier studies had recommended the construction of a 610-m outfall extension and a 305-m diffuser. The proposed extension/diffuser reportedly could meet fecal coliform receiving water standards without chlorination and prevent shore contact of the wastewater plume.

As a parallel program, the MOA undertook preparation of a wastewater master plan for the Anchorage Bowl area. The resultant Wastewater Facilities Plan for Anchorage, Alaska (Ott Water Engineers, Inc. et al., 1982) and the Environmental Impact Statement, City of Anchorage, Alaska, Wastewater Facilities (EPA and Jones & Stokes, 1982) were accepted by the EPA and the Alaska Department of Environmental Conservation (ADEC).

Further studies were subsequently undertaken to derive design criteria for the outfall improvements. Significant efforts were included in this study to improve the reconnaissance level data upon which the outfall length and diffuser design were to be based and to evaluate bacterial standards applicable to Knik Arm. The central issue was to evaluate outfall design alternatives and the chlorination or no-chlorination option in relation to the presence of a system of eddies that occur to the east of Point Woronzof on the flood tide and that might be capable of transporting the effluent shoreward.





**Figure 1. General Study Area.**

These latter studies were completed and presented as an Amendment to the Wastewater Facilities Plan for Anchorage, Alaska (CH2M Hill et al., 1985). This amended plan recommended use of the existing 245-m outfall with the addition of a three-nozzle diffuser. It was shown that chlorination would be required to meet bacterial standards even with an extended outfall and diffuser. Because the same standards could be met by use of chlorination and the existing outfall, there was no need to extend the outfall. With continued chlorination, all water quality standards were predicted to be met by the amended plan.

Concurrent with the studies to amend the facilities plan, a revised application entitled Application for Modification of Secondary Treatment Requirements, Section 301(h), Clean Water Act was submitted to the EPA (CH2M Hill et al., 1984). The EPA Region 10 301(h) Review Team's Tentative Decision Document, entitled Analysis of the Section 301(h), Secondary Treatment Variance Application for the Asplund WPCF (EPA, 1985b), and a draft NPDES permit were made available for public comment on 17 January 1985. After comments and appropriate hearings, the Final Permit Decision (EPA, 1985a) was issued 13 September 1985, and the start date of the five-year NPDES Permit AK-002255-1 was listed as 16 October 1985. As required by this permit, a multi-port diffuser was installed at the Asplund WPCF outfall in the beginning of August 1987. This occurred prior to the 1987 summer water quality monitoring program. This original NPDES permit expired on 15 October 1990.

The MOA submitted a renewal application for the permit in April 1990 which addressed amendments made to the 301(h) provisions by the Water Quality Act. That renewal application was not acted upon and the facility continued to operate under an administrative extension of the 1985 permit until August 2000. In 1998 it was projected that the growth of Anchorage would result in the discharge limits contained in the 1985 permit being exceeded within a few years. Therefore, the MOA prepared and submitted another renewal application which replaced the 1990 application in October 1998 (CH2M Hill, 1998).

In tandem with the renewal application, the MOA conducted special studies and submitted a request for site-specific water quality criteria (SSWQC) to the ADEC for the Point Woronzof area of Cook Inlet in December 1998. This request for SSWQC was for turbidity and a suite of metals and was necessitated because the Alaska Water Quality Standards (AWQS) for marine waters could not be achieved for these waters as a result of the naturally high suspended sediment loads in Cook Inlet due to glacial inputs. The approach to the request was based on the EPA's recently promulgated Metals Policy which recommends the use of only the dissolved fraction of metals as bioavailable and appropriate for the protection of aquatic and associated beneficial uses of the water body. Following both agency and public review and comments, the SSWQC were incorporated into the AWQS as amended on 27 May 1999. The SSWQC for the Point Woronzof area included turbidity and the dissolved fraction of arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. At this time, EPA has not approved the SSWQC for acute nickel, acute and chronic selenium, and acute zinc since Alaska remains in the National Toxic Rule (NTR) for these pollutants. It is expected that Alaska will be removed from the NTR and the SSWQC approved by EPA for these metals in the near future (EPA, 2001; letter to ADEC).

Following the promulgation of these new AWQS, a tentative decision to grant the MOA its 301(h) variance was made by EPA on 4 November 1999. The tentative decision, draft NPDES permit, and fact sheet were then made available for public review and comments. The State of Alaska's Division of Government Coordination issued its Final Consistency Determination for

the action in February 2000. The new NPDES permit for the Asplund WPCF was signed by EPA on 30 June 2000, went into effect 2 August 2000, and expires on 2 August 2005.

The NPDES permit specified the required monitoring program. The Monitoring Program Plan (Kinnetic Laboratories, Inc., 2000a), submitted to the EPA in October 2000, identified how the MOA plans to fulfill the requirements of this program. This report documents the progress and results of the monitoring program during the second year (January - December) under the current NPDES permit.

### **1.1.2 Environmental Background**

The Asplund WPCF discharges to the receiving waters of Cook Inlet, Alaska. The discharge is located off Point Woronzof in Knik Arm of Upper Cook Inlet.

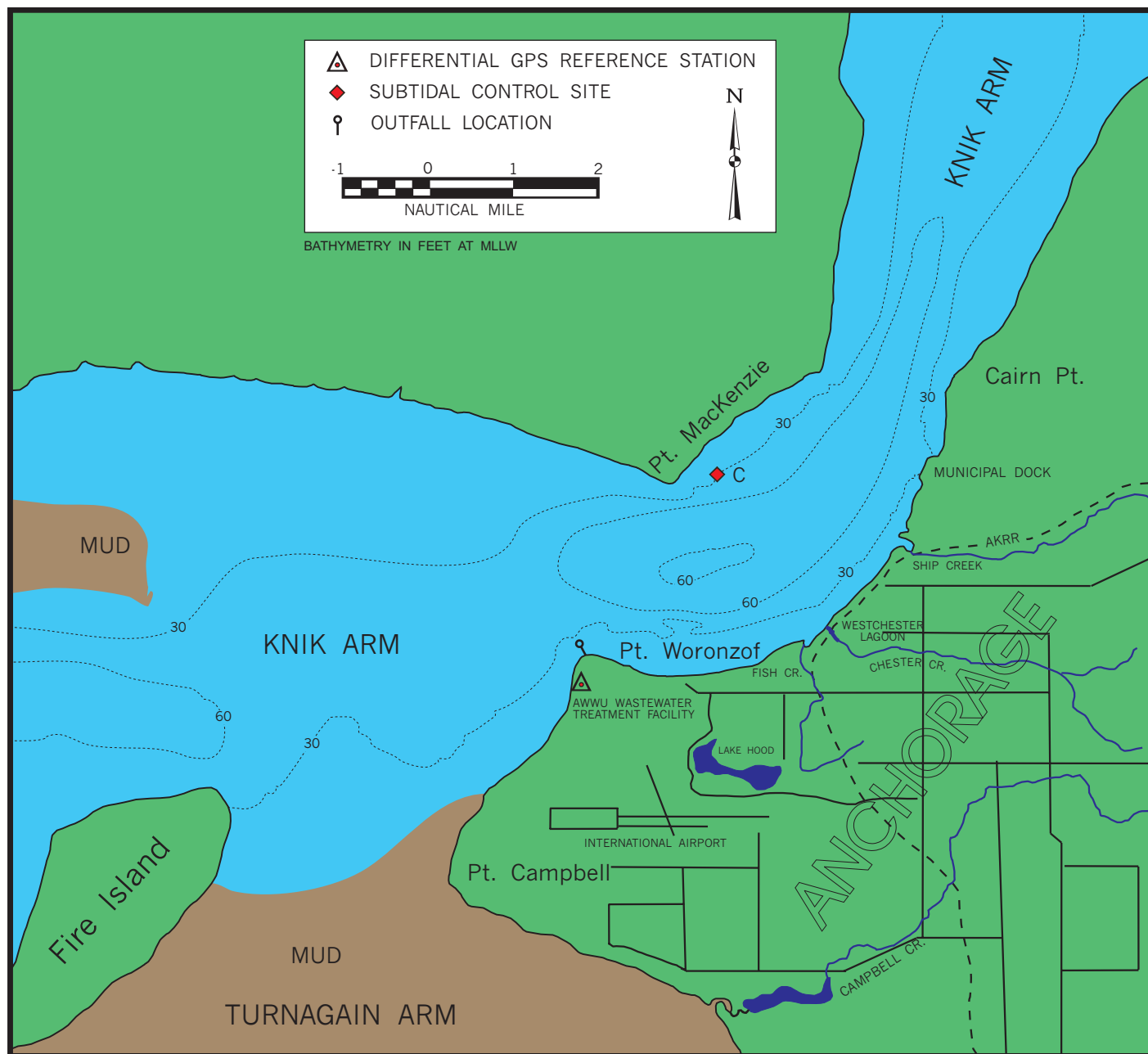
Cook Inlet is a major tidal estuary that is approximately 333 kilometers (km; 180 nautical miles) long and 93 - 148 km (50 - 80 nautical miles) wide at its lower end. Bathymetry indicates the Inlet is deep, generally 36.6 m (20 fathoms) north of the Forelands and about 164.6 m (90 fathoms) at the mouth. Numerous rivers, including the major Susitna River drainage, discharge into the Inlet. A detailed map of the Point Woronzof region indicates deep water (9.1 - 51.8 m) extending well past Anchorage up the Knik Arm (Figure 2).

Cook Inlet is a unique estuary, with perhaps the closest parallel being the Bay of Fundy between New Brunswick and Nova Scotia, Canada. The occurrence of tidal bores at the head, currents of 4 - 5 knots, suspended loads of up to 2500 mg/L, large temperature extremes, and moving pancake ice of up to one meter (m) thick make Cook Inlet unique. The high tidal ranges result from the geometry of the Inlet which has a natural resonance period close to the semi-diurnal tidal period. The resulting large tidal currents cause complete vertical mixing of the Inlet waters.

In addition to these features, two other factors are important to this study. They are the very large volume of saline water present in the Inlet and the degree of mixing achieved by the tidal turbulence which allow these volumes to be effective in wastewater dilution and assimilation.

The particle size distribution of the natural suspended sediments off Point Woronzof show that very large particles are suspended by the current-generated turbulence, with 50 percent of the load being in the size range of 65 - 250 microns. The settling of large particles is seen in the Inlet at slack tide. Settling rate tests of the suspended material show that 93 percent of the solids in the ambient water sample settle in twenty minutes.

Previous work has indicated that due to the extremely swift currents, no seabed accumulation of suspended sediments, either natural or from the discharge, occur in the vicinity of the outfall. In this location, the bottom is strictly coarse gravel and cobble because of these currents. However, areas of deposition do exist, such as to the east of Point Woronzof, where mudflats and beaches are found, and to the southwest of the Point. The area between Fire Island and the mainland is hard-packed sand with no deposition of silt or finer materials as a result of the high current energy. Silt sedimentation is a difficult problem at the Port of Anchorage where the Corps of Engineers conduct annual dredging operations. Of course, any suspended solids in these



**Figure 2. Asplund WPCF Outfall, Differential GPS Station, and Control Station Locations.**

materials of effluent origin would be diluted by the much larger natural load in the receiving water (400 - 2,500 mg/L versus approximately 50 mg/L effluent).

Studies have also shown that essentially no benthic biota are found on the scoured cobble/gravel bottom or on the rock beaches at Point Woronzof and the control area. Similar sampling of soft bottom beaches and tidal flats showed very sparse abundances and very low diversities. The harsh physical environment of silt, turbulence, currents, tides, and ice limit benthic and intertidal marine fauna populations.

Current trajectories in the immediate vicinity of the outfall are of concern because of flow separation zones on either side of Point Woronzof. Previous work has indicated that, on a flood tide, a clockwise system of eddies exist east of Point Woronzof. These eddies may result in the shoreward transport of wastes at certain stages of tide. A flow separation also exists to the west of Point Woronzof during ebb flow, however the effluent is not entrained shoreward in this area.

## **1.2 STUDY DESIGN**

### **1.2.1 Monitoring Objectives**

The monitoring program as described by NPDES Permit No. AK-002255-1 includes plant influent/effluent sampling; sewage sludge management procedures; water quality monitoring; biological and toxicological monitoring; and a toxics control program. The objectives of the overall monitoring program are to:

- determine compliance with the NPDES permit
- determine compliance with State of Alaska water quality criteria
- determine effectiveness of the industrial pretreatment program
- aid in assessing the water quality at the discharge point
- characterize toxic substances
- monitor plant performance
- determine compliance with the regulatory criteria of Section 301(h) of the Clean Water Act (CWA)
- determine the level of bacterial concentrations in nearshore waters
- monitor for changes in sediment quality (organic enrichment, alteration of grain size distribution, and pollutant contamination)
- determine if pollutants from the discharge are accumulating in exposed biological organisms
- provide data for evaluation of permit re-issuance

### **1.2.2 Program Description**

The elements of the monitoring program for the Asplund WPCF are:

- Influent, Effluent, and Sludge Monitoring, including
  - In-Plant Sampling
  - Toxic Pollutants and Pesticides (including Metals and Cyanide)
  - Pretreatment Program
  - Whole Effluent Toxicity Testing (WET)

- Receiving Water Quality Monitoring, including
  - Plume Dispersion
  - Intertidal Bacteria
- Biological and Sediment Monitoring, including
  - Sediment Quality
  - Bioaccumulation

Table 1 provides an overview of the general monitoring requirements as described by the permit. Detailed information regarding each of these program components is provided in Section 2.0, Methods.

### 1.2.3 Hypotheses

The null (no effect) hypotheses tested in Year 2 of the new NPDES permit were the following:

*H<sub>01</sub>: Applicable State and Federal effluent and receiving water standards were met by the Asplund WPCF discharge.*

*H<sub>02</sub>: Water quality at the boundary of the ZID was not significantly changed with respect to nearfield or control stations.*

## 1.3 CONTRACTOR

The MOA's designated contractor for the 2001 Asplund WPCF Monitoring Program was Kinnetic Laboratories, Inc. (KLI) of Anchorage, Alaska.

For influent, effluent, and sludge monitoring, volatile and semi-volatile priority pollutant analyses (gas chromatography/mass spectrometry scans) were performed by Northern Testing Laboratories, Inc. (Anchorage, Alaska). Trace metals (total and dissolved antimony, selenium, and thallium), aromatic hydrocarbons, pesticide, and WET testing were conducted by ToxScan, Inc. in Watsonville, California. Asbestos analyses were performed by Solar Environmental Services, Inc. of Anchorage, Alaska.

In addition, the Municipality's Asplund WPCF Laboratory performed monthly in-plant monitoring and analyses as part of its self-monitoring program and conducted trace metals and cyanide analyses for the toxic pollutant and pesticide, pretreatment, and Part 503 sludge monitoring.

Northern Testing Laboratories, Inc. (NTL) of Anchorage, under subcontract to KLI, also provided analytical and field support for the receiving water quality sampling for bacteriology, color, total residual chlorine (TRC). Analytical support for the receiving water sampling was also provided by Battelle Northwest for trace metals (Sequim, Washington), and by ToxScan, Inc. for aromatic hydrocarbons, total suspended solids (TSS), and cyanide. Polycyclic aromatic hydrocarbons (PAHs) and aliphatic hydrocarbon (AHC) analyses were provided by Texas A&M University's Geochemical and Environmental Research Group (GERG) in College Station, Texas.

**Table 1. Overall Monitoring Requirements.**

Parameter	Frequency	Sample Type	Remarks
In-Plant Sampling	See Table 2	See Table 2	See Table 2 - includes flow, TRC, DO, BOD <sub>5</sub> , TSS, temperature, pH, fecal coliform, total ammonia as nitrogen, enterococci bacteria, and oil and grease
Toxic Pollutants and Pesticides (including Metals and Cyanide)	2/year <sup>a</sup>	influent, 24-hr composite effluent, 24-hr composite sludge, 24-hr composite	See Table 2
Pretreatment Program	2/year <sup>a,b</sup>	influent, three 24-hr composite effluent, three 24-hr composite sludge, 24-hr composite (8 grabs/day)	Includes metals and cyanide plus percent solids for sludge
Whole Effluent Toxicity (WET) Testing	4/year <sup>c</sup>	effluent, 24-hr composite	See Table 2
Receiving Water Quality	1/year <sup>d</sup>	receiving water	See Table 5
Intertidal Bacteria	1/year <sup>e</sup>	intertidal receiving water	Fecal coliform sampling at 8 intertidal stations
Sediment	Once during the fourth year of the permit <sup>e</sup>	grab samples of surficial (0-2 cm) sediment collected at intertidal and subtidal stations <sup>f</sup>	Includes total volatile solids (TVS), toxic pollutants and pesticides (including metals and cyanide), and sediment grain size distribution
Bioaccumulation	Once during the fourth year of the permit <sup>e,g</sup>	grab samples of intertidal macroalgae ( <i>Vaucheria</i> spp.) <sup>h</sup>	Includes toxic pollutants and pesticides (including metals and cyanide)

<sup>a</sup> Twice per year sampling will be conducted twice, once in dry conditions in summer and once in wet conditions.

<sup>b</sup> The first day of three consecutive days of sampling will be part of the Toxic Pollutant and Pesticides (metals and cyanide) sampling performed twice each year.

<sup>c</sup> WET testing will be performed on a quarterly basis.

<sup>d</sup> Sampling will be conducted once per year in summer dry conditions.

<sup>e</sup> Sampling will be conducted in conjunction with the receiving water sampling.

<sup>f</sup> Sampling will be performed at Intertidal Stations 1, 2, and Control (IT-1, IT-2, and IT-C); a subtidal station located at the ZID boundary, and a subtidal control station near Point MacKenzie (in a similar water depth as the ZID boundary).

<sup>g</sup> Sampling will be performed in conjunction with the sediment analyses.

<sup>h</sup> Samples will be collected at Intertidal Stations 1 (IT-1) and Control (IT-C). Ten replicate samples will be collected within a 10-m radius of the station.

#### **1.4 PERIOD OF REPORT**

This report documents the progress and results of the monitoring program from 1 January through 31 December 2001 under the current NPDES permit.





## 2.0 METHODS

### 2.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING

Influent, effluent, and sludge monitoring is outlined in Table 2. Routine daily, weekly, and monthly sampling of conventional pollutant parameters and flow rate were performed by AWWU. The less-frequently monitored parameters of enterococci bacteria, oil and grease, toxic pollutants and pesticides (including metals and cyanide), and Whole Effluent Toxicity (WET) testing were handled by KLI.

- ✓ determine compliance with the NPDES permit and State of Alaska water quality criteria
- ✓ determine effectiveness of the industrial pretreatment program
- ✓ aid in assessing the water quality at the discharge point
- ✓ characterize toxic substances
- ✓ help monitor plant performance
- ✓ determine compliance with the regulatory criteria of Section 301(h) of the CWA
- ✓ provide data for evaluating re-issuance of this permit

#### 2.1.1 In-Plant Monitoring

In-plant influent, effluent, and sludge sampling was performed by AWWU personnel as described in Table 2 and in a separate study plan provided by AWWU (AWWU, 2000). Samples were obtained following the schedule of frequency required by the permit. Influent was sampled at a representative location in the influent headworks, upstream from the recycle streams. Effluent was sampled at a well-mixed point downstream from the chlorination input (the final effluent line). Composite sludge samples were obtained from the belt filter press. Grab samples were obtained for TRC, dissolved oxygen (DO), temperature, pH, and fecal coliform. Composite samples were obtained for analysis of biochemical oxygen demand (BOD<sub>5</sub>), TSS, and total ammonia as nitrogen.

#### 2.1.2 Toxic Pollutant and Pesticide Monitoring

As outlined in the permit, toxic pollutant and pesticide sampling was conducted twice this year, once during June 2001 (Summer Dry) and once during September 2001 (Summer Wet ). Samples were collected as required by the permit and either analyzed by AWWU personnel or provided to KLI for shipment to the appropriate analytical laboratory. Plant influent was sampled as discrete grabs or by flow-proportional composite samplers (depending on the analysis method) at a representative location in the influent headworks upstream from the recycle streams. Effluent was sampled as discrete grabs or flow-proportional samplers at a well-mixed point downstream from the chlorination input point in the final effluent line. Influent and effluent samples were chilled as required during composite sampling. Composite sludge samples were obtained from the belt filter press.

Samples were composited for the analysis of pesticides, semi-volatile organics, metals, asbestos, and cyanide. Samples consisted of composites of flow-proportioned samples collected over a 24-hr period using two ISCO Model 3700 Refrigerated Autosamplers. Grab samples for volatile organics analysis were collected every three hours during the 24-hr sampling period and designated for compositing during analysis at the laboratory. Grab samples were collected for

**Table 2. Influent, Effluent, and Sludge Monitoring Requirements.**

Parameter	Sample Point <sup>a</sup>	Sample Frequency	Sample Type
Flow <sup>b</sup>	effluent	continuous	continuous
Total Residual Chlorine (TRC) <sup>b</sup>	effluent	continuous <u>or</u> every 2-4 hrs	grab
Dissolved Oxygen (DO) <sup>b</sup>	effluent	4/week	grab
Biochemical Oxygen Demand (BOD <sub>5</sub> ) <sup>b</sup>	influent and effluent	4/week	24-hr composite
Total Suspended Solids (TSS) <sup>b</sup>	influent and effluent	4/week	24-hr composite
Temperature <sup>b</sup>	influent and effluent	4/week	grab
pH <sup>b</sup>	influent and effluent	4/week	grab
Fecal Coliform Bacteria <sup>b</sup>	effluent	3/week	grab
Total Ammonia as N <sup>b</sup>	effluent	1/month	24-hr composite
Enterococci Bacteria <sup>c</sup>	effluent	2/year <sup>d</sup>	grab
Oil and Grease <sup>b</sup>	effluent	2/year <sup>d</sup>	grab
Toxic Pollutants and Pesticides (including Metals and Cyanide) <sup>e</sup>	influent, effluent, and sludge	2/year <sup>d</sup>	24-hr composite
WET <sup>f</sup>	effluent	4/year <sup>f</sup>	24-hr composite

<sup>a</sup> When both influent and effluent samples are required, samples will be collected during the same 24-hr period.

<sup>b</sup> AWWU will perform this monitoring component.

<sup>c</sup> KLI will perform this monitoring component.

<sup>d</sup> Twice per year sampling: once during summer in dry conditions and once in wet conditions.

<sup>e</sup> As part of the pretreatment program sampling requirements, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc in influent, effluent, and sludge will be sampled, along with percent solids (in sludge only). These metals will be analyzed and reported by AWWU as total recoverable metals and dissolved metals for influent and effluent and as total metals in mg/kg dry weight for sludge. Sampling will be as follows: Influent and effluent as three separate 24-hr composite samples taken on 3 consecutive days (Mon - Fri), the first day of which coincides with the twice yearly sampling (summer-dry and wet conditions); sludge as one composite of eight grabs/day when influent and effluent samples are being taken. In addition, the other four metals from the toxic pollutant list will be analyzed in the summer wet/summer dry samples: beryllium (by AWWU) and antimony, thallium, and selenium (by KLI).

<sup>f</sup> WET requirements are summarized in the text. Initial testing will be a screening period performed during three quarters, during which three species will be tested to determine the most sensitive species. Re-screening will be performed each year during one quarter (different than the previous year) to determine the species to use for continued testing. Accelerated testing requirements will be triggered if chronic toxicity is greater than 143 TUc (chronic toxicity units, TUc=100/NOEC).

analysis of total hydrocarbons as oil and grease and purgeable aromatic compounds. Sludge samples were collected from the conveyor belt every three hours over a 24-hr period and the eight samples composited.

At time of collection, all samples were appropriately labeled using pre-prepared, project-specific sample labels as described in Section 2.4. Sample collection and shipment was documented using project-specific chain of custody forms as described in Section 2.4.

Toxic pollutants as defined by the permit are those substances listed in 40 CFR 401.15 (Table 3). This list involves 65 categories of pollutants, including asbestos, aromatic hydrocarbons, pesticides, metals, and polychlorinated biphenyls (PCBs). Pesticides as defined in the permit are demeton, guthion, malathion, mirex, methoxychlor, and parathion as listed in 40 CFR 125.58. Other pesticides which were tested are included on the toxic pollutants list (40 CFR 401.15). The methods that were used to analyze these constituents for this program and for which KLI will be responsible, as well as those performed by AWWU, are also provided in Table 3. Preservation and maximum holding time information for each of these methods is provided in Table 4. All samples were collected in the appropriate precleaned sample containers and preserved, if necessary, as described by the EPA method. All sample containers were immediately placed on gel ice after sampling. Samples remained chilled as required during shipment to the analytical laboratory.

### **2.1.3 Pretreatment Monitoring**

The pretreatment program as outlined in Table 1 and Table 2 was performed by the AWWU. This monitoring was performed for the first time in August 2000, conducted twice in 2001, and will be performed twice per year in the future in conjunction with the summer dry and wet sampling. As part of the pretreatment program sampling requirements, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc in influent, effluent, and sludge will be sampled, along with percent solids (in sludge only). These metals will be analyzed and reported by AWWU as total recoverable metals and dissolved metals for influent and effluent and as total metals in dry weight for sludge. Sampling will be as follows: Influent and effluent as three separate 24-hr composite samples taken on 3 consecutive days (Monday - Friday), the first day of which coincides with the twice yearly sampling (dry summer and wet conditions); sludge as one composite of eight grabs/day when influent and effluent samples are being taken. A study plan describing this has been provided elsewhere (AWWU, 2000).

### **2.1.4 Whole Effluent Toxicity Testing**

As outlined in the permit, the WET testing must be performed on a quarterly basis on 24-hour composite effluent samples. Effluent was sampled by discrete flow-proportional samplers at a well-mixed point downstream from the chlorination input point in the final effluent line. Effluent samples were collected in the appropriate precleaned sample containers as described by the method, chilled, and shipped immediately to the toxicity laboratory for testing. Samples were appropriately labeled at the time of collection using pre-prepared, project-specific sample labels as described in Section 2.4. Sample collection and shipment were documented using project-specific chain of custody forms as described in Section 2.4. Sample containers were immediately placed on gel ice after sampling and remained chilled during shipment to the analytical laboratory.

**Table 3. Methods<sup>a</sup> for the Analysis of Toxic Pollutants and Pesticides for Influent, Effluent, and Sludge Monitoring.**

Volatile Organic Compounds	Semi-Volatile Organic Compounds	Pesticides and PCBs	Inorganic Compounds
<b>EPA 602 (Inf/Eff)</b> <b>SW 8260B (Sludge)</b> Benzene Chlorinated benzenes Dichlorobenzenes Ethylbenzene Toluene Xylenes <sup>b</sup>	<b>EPA 625 (Inf/Eff)</b> <b>SW 8270C (Sludge)</b> Acenaphthene Benzidine <sup>c</sup> Chloralkyl ethers Chlorinated ethanes Chlorinated naphthalenes Chlorinated phenols 2-chlorophenol DDT & metabolites Dichlorobenzenes Dichlorobenzidine 2,4-dichlorophenol 2,4-dimethylphenol Dinitrotoluene Diphenylhydrazine Fluoranthene Haloethers Heptachlor & metabolites Hexachlorobutadiene Hexachlorocyclopentadiene <sup>c</sup> Hexachloroethane Isophorone Naphthalene Nitrobenzene Nitrophenols Nitrosamines Polycyclic aromatic hydrocarbons (PAHs) Pentachlorophenol Phenol Phthalate esters	<b>EPA 614 (Inf/Eff)</b> <b>SW 8141A (Sludge)</b> Demeton Malathion Parathion Guthion <sup>b</sup>	<b>EPA 100.1/EPA 100.2 (Inf/Eff)</b> Polarized Light Microscopy (PLM; Sludge) Asbestos
<b>EPA 624 (Inf/Eff)</b> <b>SW 8260B (Sludge)</b> Acrolein <sup>b</sup> Acrylonitrile <sup>b</sup> Benzene Carbon tetrachloride Chloralkyl ethers Chloroform Chlorinated benzenes Chlorinated ethanes 1,2-dichloroethane Dichloroethylenes Dichloropropane Dichloropropene 1,1,1-trichloroethane Ethylbenzene Halomethanes Methylene chloride Bromoform Dichlorobromomethane Toluene Tetrachloroethylene Trichloroethylene Vinyl chloride	<b>EPA 608 (Inf/Eff)</b> <b>SW 8081A Pesticides and SW 8082 PCBs (Sludge)</b> Aldrin/Diedrin Chlordane (technical mixture& metabolites) DDT & metabolites Endosulfan & metabolites Endrin & metabolites Heptachlor metabolites Hexachlorocyclohexane Polychlorinated biphenyls (PCBs) Toxaphene Mirex <sup>b</sup> Methoxychlor <sup>b</sup>	<b>EPA 200.8 (Inf/Eff)</b> <b>SW 6020/SW 3050B (Sludge)</b> Antimony Thallium  <b>EPA 270.3 (Inf/Eff)</b> <b>SW 7741A/SW 3050B (Sludge)</b> Selenium  Note: other inorganic compounds will be analyzed by AWWU (Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Zinc, and Cyanide)	
	<b>SW 8280A (Inf/Eff/Sludge)</b> 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)		

Inf Influent

Eff Effluent

<sup>a</sup> "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020 or 40 CFR 136; "SM" refers to *Standard Methods for the Examination of Water and Wastewater*, 18th ed., 1992. "SW" refers to the EPA Manual SW 846, *Test Methods for Evaluating Solid Waste*. 3rd Ed., 1986.

<sup>b</sup> Included with expanded method analyte list.

<sup>c</sup> Not the preferred method for this analyte.

**Table 4. Preservation and Analytical Procedures for Influent, Effluent, and Sludge.**

<b>Parameter</b>	<b>Sample Type</b>	<b>Preservation</b>	<b>Maximum Holding Time</b>	<b>Method<sup>a</sup></b>
Temperature	Inf/Eff	None required	Analyze immediately	SM 2550B
pH	Inf/Eff	None required	Analyze immediately	SM 4500-H <sup>+</sup> B
BOD <sub>5</sub>	Inf/Eff	Cool, 4 °C	48 hours	SM 5210B
Total Residual Chlorine	Eff	None required	Analyze immediately	Hach 8167
DO Electrode	Eff	None required	Analyze immediately	SM 4500-O G
Suspended solids	Inf/Eff	Cool, 4 °C	7 days	SM 2540D
Total solids	Sludge	Cool, 4 °C	7 days	SM 2540G
Enterococci	Inf/Eff	Cool, 4 °C, Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> in effluent	24 hours	SM 9230B
Asbestos	Inf/Eff	Cool, 5 °C, dark	Filter within 48 hours of receipt at lab	EPA 100.1/100.2
	Sludge	Cool, 5 °C	28 days	Polarized Light Microscopy (PLM)
Fecal Coliform Bacteria	Eff	Cool, 4 °C 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	6 hours	EPA 600/8-78-017
Total Ammonia as N	Eff	Cool, 4 °C, H <sub>2</sub> SO <sub>4</sub> to pH <2	28 days	Hach 8038
Total Hydrocarbons as Oil and Grease	Inf/Eff	Cool, 4 °C, dark HCl to pH <2	28 days	EPA 1664, Rev. A, HEM <sup>b</sup>
Volatile Organics	Inf/Eff	Cool, 4 °C, dark, HCL to pH <2 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> in effluent	14 days	EPA 624, EPA 602 and xylenes
	Sludge	Cool, 4 °C	14 days	SW 8260B
Dioxins	Inf/Eff	Cool, 4 °C	30 days until extraction/45 days after extraction	SW 8280A
	Sludge	Cool, 4 °C	30 days until extraction/45 days after extraction	SW 8280A
Semi-Volatile Organics	Inf/Eff	Cool, 4 °C, dark Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> in effluent	7 days until extraction/40 days after extraction	EPA 625
	Sludge	Cool, 4 °C	14 days until extraction/40 days after extraction	SW 8270C
Pesticides & PCBs	Inf/Eff	Cool, 4 °C, Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> in effluent	7 days until extraction/40 days after extraction	EPA 614 and EPA 608
	Sludge	Cool, 4 °C	14 days until extraction/40 days after extraction	SW 8141A/8081A SW 8082

**Table 4. Preservation and Analytical Procedures for Influent, Effluent, and Sludge.  
(continued)**

Parameter	Sample Type	Preservation	Maximum Holding Time	Method <sup>a</sup>
Cyanide (total)	Inf/Eff	Cool, 4°C, NaOH to pH>12, 0.6 g ascorbic acid (in effluent)	14 days	SM 4500 CN C,E
	Sludge	Cool, 4°C	14 days	SM 4500 CN C,E
Arsenic	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 206.2
	Sludge	Cool, 4°C	28 days	SW 7060/3050A
Beryllium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 210.2
	Sludge	Cool, 4°C	28 days	SW 7091/3050A
Cadmium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 213.2
	Sludge	Cool, 4°C	28 days	SW 7130/3050A
Chromium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 218.2
	Sludge	Cool, 4°C	28 days	SW 7191/3050A
Copper	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	SM 3111B
	Sludge	Cool, 4°C	28 days	SW 7210/3050A
Lead	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 239.2
	Sludge	Cool, 4°C	28 days	SW 7421/3050A
Mercury	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	28 days	EPA 245.1
	Sludge	Cool, 4°C	14 days	SW 7470
Nickel	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 249.2
	Sludge	Cool, 4°C	28 days	SW 7521/3050A
Selenium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 270.3
	Sludge	Cool, 4°C	28 days	SW 7741A/3050B
Silver	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 272.2
	Sludge	Cool, 4°C	28 days	SW 7761/3050A
Zinc	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	SM 3111B
	Sludge	Cool, 4°C	28 days	SW 7950/3050A
Antimony	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	28 days	SW 6020/3050B
Thallium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH <2	6 months	EPA 200.8
	Sludge	Cool, 4°C	28 days	SW 6020/3050B (digestion)

<sup>a</sup> Unless otherwise noted, "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020; "SM" refers to *Standard Methods for the Examination of Water and Wastewater*, 18th ed., 1992. "SW" refers to the EPA Manual SW 846, *Test Methods for Evaluating Solid Waste*. 3rd Ed., 1986.

<sup>b</sup> EPA, 1999a. Document No. EPA-821-R-98-002.

Inf Influent samples

Eff Effluent samples

Sludge Sludge samples

Initial testing was performed as a screening period over the course of three quarters during each of which three toxicity tests were performed, each with one vertebrate and two invertebrate species. Testing was initiated with screening tests performed during the third and fourth quarters of the year 2000. Screening continued in the first quarter of 2001. Testing has included the vertebrate *Atherinops affinis* (topsmelt) for survival and growth; an invertebrate bivalve species (either *Mytilus* spp. [mussel; survival and growth] or *Crassostrea gigas* [oyster; larval development]); and an invertebrate echinoderm species fertilization test (*Strongylocentrotus purpuratus* [purple urchin] or *Dendraster excentricus* [sand dollar]). Once the screening period was completed, the single most sensitive species was used for subsequent toxicity testing. As required by the permit, re-screening will be performed each year during one quarter (different than the previous year) to determine the most sensitive species to use for continued testing.

Accelerated testing requirements will be triggered if chronic toxicity is greater than 143 TUC (chronic toxicity units, TUC=100/No Observed Effect Concentration [NOEC]). Accelerated testing will include the implementation of the initial investigation Toxicity Reduction Evaluation (TRE) workplan along with at least one additional toxicity test. If the investigation indicates the source of toxicity (e.g., a plant upset), and no toxicity greater than 143 TUC is observed in this test, the normal schedule of testing will be re-instated. If toxicity greater than 143 TUC is observed, then accelerated testing will continue with six more tests performed on a biweekly basis over a 12-week period. Testing will commence within two weeks of receipt of the sample results of the exceedence. If no toxicity greater than 143 TUC is observed in these tests, then the normal schedule of testing will be re-instated. If toxicity greater than 143 TUC is observed in any of the six tests, then a TRE will be initiated within 15 days of receipt of the sample results of the exceedence. A Toxicity Identification Evaluation (TIE) may also be initiated as part of the overall TRE process, and if this is initiated during the accelerated testing period, the accelerated testing schedule may be terminated or used as necessary in performing the TIE.

Toxicity testing was performed as described in Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms (EPA, 1988) and the West Coast Marine Methods Manual, First Edition (EPA,1995) as required by the permit. The presence of chronic toxicity was estimated as described by these references. Quality assurance for the toxicity testing included the testing of a series of five dilutions and a control, including the concentration of the effluent at the edge of the ZID (0.70 %) as well as two dilutions above and two dilutions below 0.70 %. Reference toxicants were tested concurrently with the effluent testing, using the same procedures. If the effluent tests did not meet all the acceptability criteria as specified in the referenced methods, then the effluent was re-sampled and re-tested as soon as possible. Control and dilution water was natural or synthetic seawater as called for by the referenced methods. If the dilution water was different from the culture water, a second control using culture water will be run. Dilution water met test acceptability criteria.

As part of the WET testing, an initial investigation TRE plan was prepared and submitted to EPA under separate cover (Kinnetic Laboratories, Inc., 2000b). This plan describes the events that will occur should chronic toxicity be detected. As required by the permit and the manual Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants (EPA, 1999b), a preliminary TRE will be initiated within 15 days of the receipt of sample results of the permit exceedence. A more detailed TRE workplan will subsequently be developed to more fully investigate and identify the cause of the toxicity, identify and provide a schedule of the actions that AWWU will use to mitigate the impact of the discharge, and to prevent the



recurrence of the toxicity. As noted above, the TIE may be initiated as part of the overall TRE process during the accelerated testing schedule.

### 2.1.5 Part 503 Sludge Monitoring

Operations at the Asplund WPCF include a sludge incinerator that is subject to regulation under 40 CFR Part 503—Standards for the Use or Disposal of Sewage Sludge (Part 503). The current permit requires sludge monitoring twice per year, once during the dry conditions in summer and once during wet conditions as noted above. There are no Part 503 monitoring requirements included in the reissued permit because EPA Region 10's current policy is to remove these requirements from NPDES permits with the intention of writing "sludge only" permits in the future. However, the Part 503 regulations are "self-implementing" in that the facility is required to meet the monitoring requirements in the regulation whether they are specifically included in a permit or not. Therefore, monitoring at the Asplund WPCF includes Part 503 monitoring of sludge. Monitoring frequencies required by 40 CFR Part 503 for incineration are once per 60 days for arsenic, cadmium, chromium, lead, and nickel. Frequency required for mercury is at least once per year. Frequency for beryllium is not specified. AWWU has chosen to also test mercury and beryllium once per 60 days, more frequently than required, so as to be consistent with the testing frequency for the other metals. Allowable limits are site-specific and were calculated per Part 503 regulation in the *Air Operating Permit Application* submitted by AWWU to ADEC in December 1997 (CH2M Hill, 1997). While methods for this monitoring component have been described elsewhere (AWWU, 2000) and results of the monitoring have been provided under separate reporting requirements to EPA, the data are also included in this report.

## 2.2 RECEIVING WATER QUALITY MONITORING

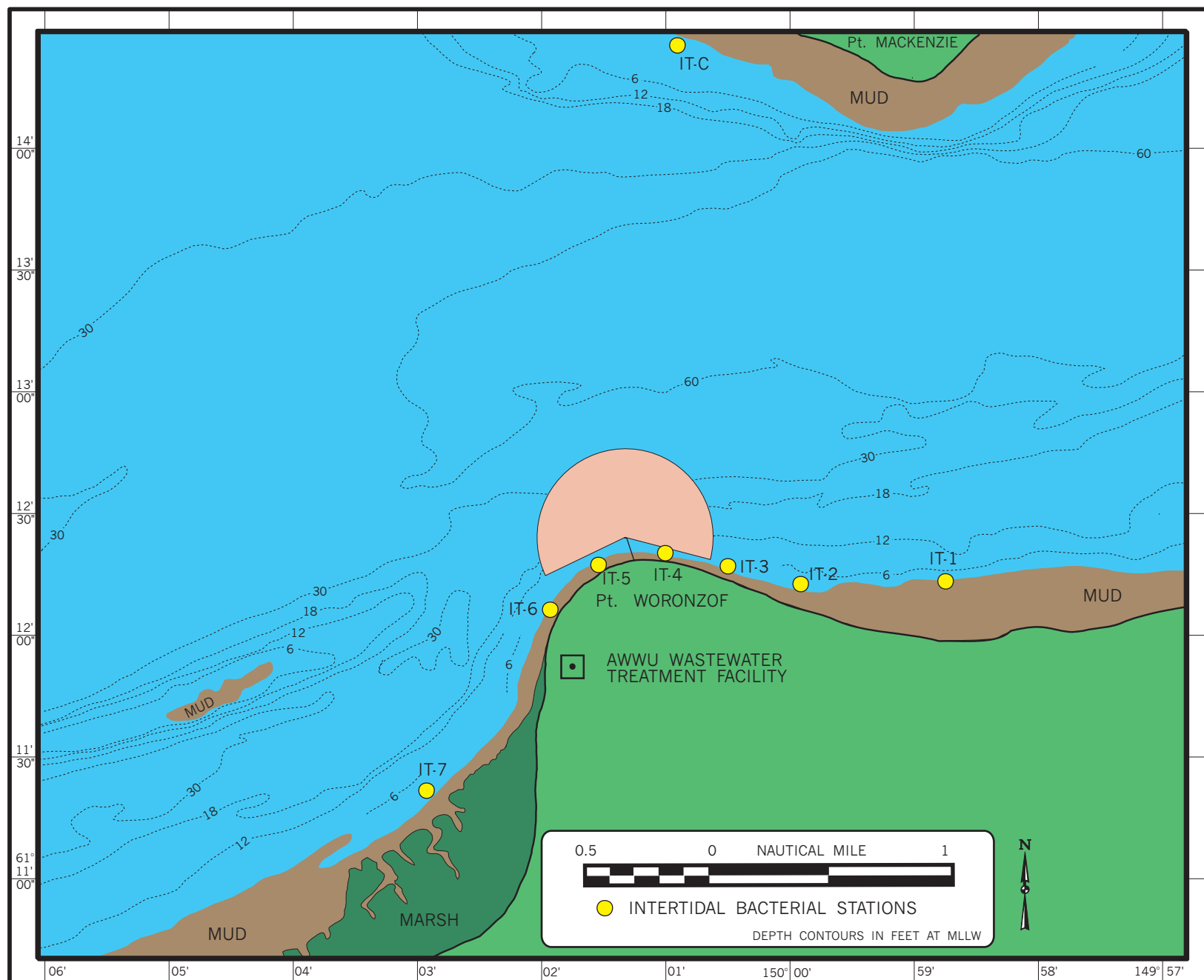
### 2.2.1 Water Quality Sampling

As called for by the permit, water quality must be monitored annually during the summer in dry weather conditions (Table 1). Sampling was performed at non-fixed stations made during consecutive ebb and flood tides at the outfall station and a single flood tide at the control station. Station locations were determined by following the track of drogues released above the diffuser at the outfall station and at the control station located north across Knik Arm from Point Woronzof, directly off Point MacKenzie in a similar water depth as the outfall. Three drogue tracks on the each tide were performed at each location. Four stations were sampled on each drogue track:

- |  |
|--|
| <ul style="list-style-type: none"><li>✓ determine compliance with the NPDES permit and State of Alaska water quality criteria</li><li>✓ aid in assessing the water quality at the discharge point</li><li>✓ determine compliance with the regulatory criteria of Section 301(h) for the CWA</li><li>✓ determine the level of bacterial contamination in nearshore waters</li><li>✓ provide data for evaluation of permit re-issuance</li></ul> |
|--|

- above the diffuser
- as close to the ZID boundary as practicable
- at least one station in the channel of Knik Arm
- in the shallow subtidal area before the drogue grounds.

As noted in the permit, the ZID is defined as the water column above the area delineated by the sector of a circle with the center located over the outfall, 30 meters (m) shoreward of the diffuser, 650 m in radius, and with a 220° angle (Figure 3).



**Figure 3. Asplund WPCF Outfall Showing the ZID and Locations for Intertidal Bacterial Sampling.**

The plume location was followed by using a holey-sock drogue (Figure 4). The drogue consisted of a six-foot cylindrical nylon tube ballasted at the bottom with a five-pound weight and attached at the top with a bridle to a spherical float. This float attached to the tracking spar via a connecting line. These cylindrical or spherical designs that enclose a parcel of water have been found to more accurately follow the ambient current patterns than other drogue designs such as the window shade design (Sombardier and Niiler, 1994).

Sampling was performed by positioning the vessel over the diffuser (or control station) for the first sampling station of the drogue track. The drogue was released at approximately the same time and followed until navigation information indicated that the ZID has been reached, at approximately 650 m from the outfall, at which time the ZID boundary station was sampled. The third and fourth stations along each drogue track were sampled as the drogue traveled through the channel in Knik Arm and as it slowed in shallow water prior to grounding. Navigation was accomplished using a differential global positioning system (DGPS) using the U.S. Coast Guard's DGPS station in Kenai, Alaska. If DGPS coordinates were unavailable or inaccurate, a standard GPS receiver was used to obtain navigational information. Range and bearing to fixed landmarks on shore using the vessel's radar may also have been recorded to aid in station positioning.

Samples were collected for the parameters outlined in Table 5. The surface waters of all stations were sampled for fecal coliform, color, and TRC. Surface samples were collected by grabbing directly into the appropriate sample bottles at sample depth (15 - 30 centimeters [cm]). Turbidity samples were collected at all stations from surface (0.5 m), mid-, and bottom depths using Niskin® bottles. Mid- and bottom depths were determined at each station using the survey vessel's fathometer. Samples were collected as simultaneously as possible at all three target depths. Hydrographic profiles of temperature, salinity, and pH were collected at all stations using a Seabird SEACAT® CTD (conductivity, temperature, and depth) sensor. This instrument was also equipped with a DO sensor to allow DO profiles to be recorded. Samples for the analysis of total and dissolved metals, TSS, hydrocarbons (PAH and AHC), and volatile aromatic hydrocarbons were collected from surface waters at the first three stations (diffuser, ZID boundary, and channel) along the first flood drogue track at both the outfall and control stations. These samples were collected directly into the appropriate sample containers. A single replicate sample for each parameter or a single profile was collected at each station except for quality control samples, which are described in Section 4.2.

Samples were analyzed following the methods provided in Table 6. Samples were appropriately labeled at time of collection using pre-prepared, project-specific sample labels as described in Section 2.4 and prepared for shipment to the laboratory. Preservation and maximum holding time information for each of these methods is also provided in Table 6. All sample containers were immediately placed on gel ice after sampling. Samples remained chilled as required during shipment to the analytical laboratory.

### **2.2.2 Intertidal Bacterial Sampling**

As part of the water quality monitoring effort, intertidal sampling for fecal coliform bacteria was also performed at eight intertidal stations provided in Table 7 and depicted in Figure 3. Two replicate water samples were collected from each station at slack high water when the water depths were between 1 to 3 feet (ft). Additional quality control samples were collected as

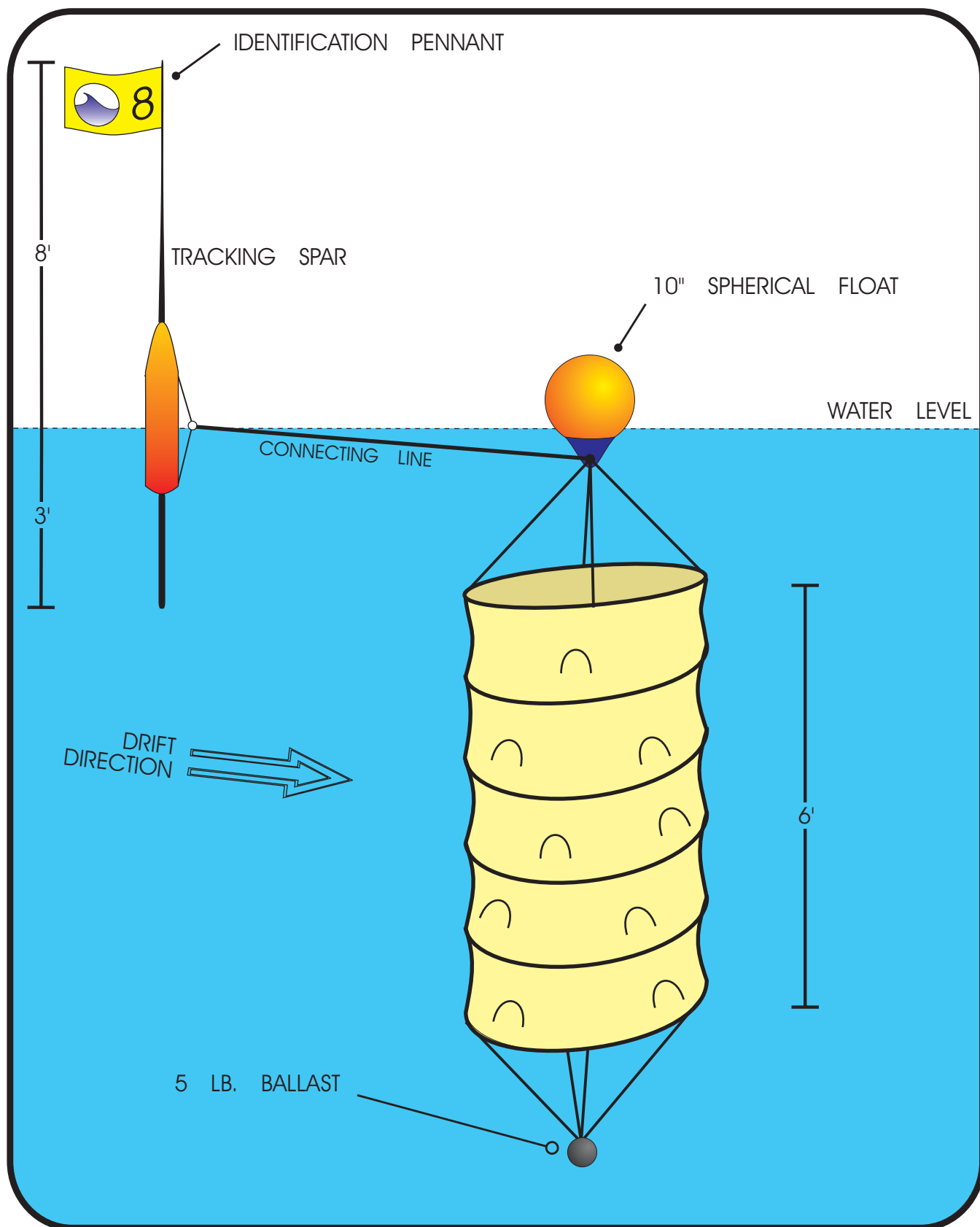


Figure 4. Holey-Sock Drogue, Flotation, and Marker Buoy.

**Table 5. Receiving Water Quality Monitoring Requirements.**

Parameter	Sampling Depth		
	Surface (above 0.5 m)	Surface, Mid-, and Bottom	Profile (1- to 3-m intervals)
Fecal Coliform	all stations <sup>a</sup> , within the 15-30 cm layer		
Color	all stations		
Total Residual Chlorine (TRC)			
Field Observations: presence or absence of floating solids, visible foam (other than trace), oil wastes, and/or sheen	all stations where surface samples are collected		
Total Aqueous Hydrocarbons (TAqH)	first three stations along the first flood drogue track at both the outfall and control locations		
Total Aromatic Hydrocarbons (TAH)			
Metals and Cyanide <sup>b</sup>			
Total Suspended Solids (TSS)			
Turbidity		all stations	
Dissolved Oxygen (DO)			
pH			all stations
Temperature			
Salinity			

<sup>a</sup> Non-fixed stations will be sampled following the track of drogues released at the diffuser (outfall station) or at a fixed station having the same depth due north across Knik Arm from Point Woronzof near Point MacKenzie (control station). Three drogue tracks will be made during each of a consecutive flood and ebb tide at the outfall station. Three drogue tracks will be made during a flood tide at the control station in conjunction with or as soon as practicable as the sampling at the outfall station. Stations will include the following along each drogue track: above the diffuser; as close to the ZID boundary as possible; at least one station in the channel in Knik Arm; and the shallow subtidal area (before the drogue grounds).

<sup>b</sup> Metals including arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc will be analyzed and reported as total recoverable metals and dissolved metals.

**Table 6. Methods, Preservation, and Maximum Holding Times for the Analysis of Receiving Water Quality Samples.**

Parameter	Method <sup>a</sup>	Preservation	Maximum Holding Time
Fecal Coliform	SM 9221E	Cool, 4°C, dark	24 hours
Color	SM 2120B	Cool, 4°C, dark	48 hours
Total Residual Chlorine (TRC)	SM 4500-Cl D	None	Analyze immediately
Turbidity	SM 2130B	Cool, 4°C, dark	24 hours
Total Aqueous Hydrocarbons (TAqH)	EPA 602 plus xylenes	Cool, 4°C, HCl to pH<2, Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> in presence of chlorine	14 days
	EPA 610	Cool, 4°C, dark, Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> in presence of chlorine	7 days until extraction 40 days after extraction
Total Aromatic Hydrocarbons (TAH)	EPA 602	Cool, 4°C, HCl to pH<2 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> in presence of chlorine	14 days
Metals (Total Recoverable and Dissolved)	See note <sup>b</sup>	Cool, 4°C, HNO <sub>3</sub> to pH <2 (after filtration for dissolved)	28 days
Cyanide	EPA 335.3	NaOH, 4°C	14 days
Total Suspended Solids (TSS)	EPA 160.2	Cool, 4°C	7 days
Dissolved Oxygen (DO)	SM 4500-O G (electrode)	None	<i>in situ</i>
Dissolved Oxygen (DO) (Winkler)	SM 4500-O C	MnSO, alkali-iodide and H <sub>2</sub> SO <sub>4</sub>	8 hours
pH	SM 4500-H <sup>+</sup> B	None	<i>in situ</i>
Temperature	SM 2550B <sup>c</sup>	None	<i>in situ</i>
Salinity	SM 2520B <sup>c</sup>	None	<i>in situ</i>

<sup>a</sup> "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020, or 40 CFR 136. "SM" refers to *Standard Methods for the Examination of Water and Wastewater*, 18th ed., 1992.

<sup>b</sup> Dissolved metals will be filtered before acidification; total recoverable metals will be digested by ASTM Method D4309-91. Cadmium, chromium, copper, nickel, lead, and zinc will be subject to pre-concentration by chelation following EPA Method 1640 prior to analysis by inductively coupled plasma mass spectroscopy. These metals, along with antimony, beryllium, selenium, and thallium, will be analyzed as total recoverable and dissolved metals as appropriate for ICP/MS (EPA Method 1638). Mercury will be analyzed using cold vapor atomic fluorescence following EPA Method 1631. Arsenic will be determined in all samples by flame ionization atomic spectroscopy (SW846 Method 7062). Silver will be determined by graphite furnace atomic absorption (EPA Method 200.9).

<sup>c</sup> Modified for *in situ* measurements collected with the CTD.

**Table 7. Approximate Locations of Intertidal Bacteria Sampling Stations.**

Station	Station Location Relative to Diffuser	Latitude (N)	Longitude (W)
IT-1	2000 m east	61° 12' 10"	149° 58' 55"
IT-2	1200 m east	61° 12' 11"	149° 59' 50"
IT-3	750 m east	61° 12' 15"	150° 00' 20"
IT-4	250 m east-southeast	61° 12' 19"	150° 00' 52"
IT-5	250 m south	61° 12' 15"	150° 01' 10"
IT-6	750 m southwest	61° 12' 02"	150° 01' 28"
IT-7	2000 m southwest	61° 11' 22"	150° 02' 02"
IT-C	Across Knik Arm from the diffuser	61° 14' 26"	150° 01' 09"

described in Section 4.1. Samples were collected by grabbing from 15 - 30 cm depths directly into the appropriate container. Samples were analyzed using the same procedures described above and in Table 6.

In addition to the required intertidal samples, two replicated fecal coliform samples were also collected once during the water quality monitoring effort from three area streams that empty into Knik Arm: Ship, Chester, and Fish Creeks. Samples were analyzed using the same procedures described above and in Table 6.

At time of collection, all fecal coliform samples were appropriately labeled using pre-prepared, project-specific sample labels as described in Section 2.4. All samples were collected in the appropriate precleaned sample containers and preserved, if necessary, as described by the method. Samples were placed on gel ice immediately after sampling and remained chilled during transport to the laboratory. Field notes, including navigational and sampling information, were recorded on project-specific field logs. As required by the permit, field observations taken at each station included the presence or absence of floating solids, visible foam in other than trace amounts, oily wastes, or sheen. Weather observations were also recorded. All field documentation was reviewed by the field leader at the completion of the survey. Sample collection and shipment was documented using project-specific chain of custody forms as described in Section 2.4.

### **2.2.3 Vessel Support**

The 20-ft survey vessel was used for drogue tracking and water sampling in 2001. In addition, a 14-ft Zodiac® was used to retrieve grounded drogues and conduct intertidal bacteria sampling. The Zodiac® was also used to transport samples with short holding times (e.g., DO, TRC, and bacterial samples) ashore.

## **2.3 LABORATORY ANALYSIS**

Laboratory analyses of all samples for this program followed preservation and analysis procedures described by EPA-accepted protocols as referenced in this document (Table 4 and Table 6). These procedures are fully described by the referenced documents and/or 40 CFR 136.

## **2.4 DOCUMENTATION PROCEDURES**

All field and sampling data was recorded on appropriate pre-printed project-specific field data forms. Field data forms included drogue tracking forms, water sampling log forms, sample identification/chain of custody forms, and sample labels. These log forms were tailored to the monitoring program to facilitate accurate and complete documentation of field activities. The field task leader was responsible for review and approval of all field documentation; this was completed as soon as possible after sampling.

Sampling logs included specific information such as station identification, sample identification numbers, navigational data, sampling or photographic observations, sampling depths, and collection date and time. Names of personnel performing the sampling were recorded on each log. Drogue tracking logs included station identification information along with navigational data to allow the track of each drogue to be determined and plotted. Pre-printed labels included such information as station designation, analysis type, date of collection, sampling personnel, and a pre-assigned sample identification number to uniquely identify each sample. Quality control samples were labeled as were regular environmental samples so as to be blind to the laboratory analysts.

Sample identification and integrity was ensured by a rigidly-enforced chain of custody program. Sample identification/chain of custody forms (COCs) provided specific information concerning the identification, handling, and shipment of samples.

Pertinent information from the sample label was transferred onto the COC, along with other information as required. COC forms were completed, signed by field personnel, and copied if needed. In some cases, where photocopying was not convenient or possible, two-part carbonless forms were used. The original of each COC form was packed with the samples in coolers for shipment to the laboratory. The field task leader retained a copy of each form for the field records and for tracking purposes should a shipment become lost or delayed. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian signed the samples in by checking all sample labels against the COC information and noting any discrepancies as well as sample condition (e.g., containers leaking or damaged during shipment). Internal sample tracking procedures at the laboratory were initiated immediately upon receipt of samples as described by each laboratory's standard operating procedure.

## **2.5 SEDIMENT AND BIOACCUMULATION MONITORING**

As stipulated in the NPDES permit, no sediment or bioaccumulation monitoring was performed during the program year 2001.





### **3.0 RESULTS**

#### **3.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING**

##### **3.1.1 Monthly Discharge Monitoring Data**

Results of AWWU's daily, weekly, and monthly sampling of the wastewater treatment plant influent and effluent for non-metals are presented as monthly summaries in Table 8. Averages and percent removal rates are based on the 12-month period from January through December 2001.

Removal of BOD<sub>5</sub> averaged 42 % for the year, and removal of TSS averaged 81 % for the 12-month reporting period. These averages far exceed the minimum values required by the amendments to the Clean Water Act (40 CFR Part 125.60; Final Rule, 8/9/94), whereby dischargers with 301(h) waivers are required to remove 30 % of BOD<sub>5</sub> and 30 % of the suspended solids. The highest monthly average effluent BOD<sub>5</sub> was 156 mg/L, substantially less than the permit limitation of 240 mg/L. All of the BOD<sub>5</sub> values (daily, weekly, and monthly averages) reported for the calendar year 2001 met the permit limitations. Total suspended solids concentrations in the effluent were low and typical of those seen historically at Point Woronzof with the highest monthly average effluent concentration of 61 mg/L compared to the permit limit of 170 mg/L. The yearly TSS average was 46 mg/L. Weekly average and daily maximum TSS also met permit requirements.

The highest mean monthly fecal coliform bacteria count was 119 MPN/100 mL compared to the permit limitation of 850 MPN/100 mL based on a geometric mean of at least five samples. The concentration of TRC averaged 0.8 mg/L for the year compared to the maximum daily permit limitation of 1.2 mg/L. The TRC daily maximum limit was exceeded once in December 2001, but other TRC permit limitations were met. Although other parameters such as DO, pH, and temperature do not have permit limitations, ranges were typical of those seen historically.

##### **3.1.2 Toxic Pollutants and Pesticides Analyses**

Toxic pollutant and pesticide monitoring for influent, effluent, and sludge was conducted on 19 – 20 June 2001 for summer-dry weather and 4 - 5 September 2001 for the Summer Wet sampling. Sampling was performed over a 24-hour period by AWWU personnel.

Results of the toxic pollutant and pesticide analyses are provided in Table 9 (June 2001) and Table 10 (September 2001). For semi-volatile (EPA Methods 625/8270C) organic compounds, volatile (EPA Methods 624/8260B) organic compounds, and pesticides (EPA Methods 608/8081 and 614/8141A), only those pollutants that were detected in the influent, effluent, or sludge are listed. Refer to Appendices A and B for a complete listing of toxic pollutants and pesticides analyzed. A number of the constituents were found only in the sludge. Pollutants found in the influent were often detected in the effluent, and vice versa. In general, pollutant concentrations were low. Many of the concentrations reported for two samplings were below detection limits.

**Table 8. Discharge Monitoring Data for Influent and Effluent Non-Metals.**

Month	Average Flow Rate (MGD)	Temperature Average (°C)		pH Minimum/Maximum (pH)		TRC Average (mg/L)		D.O. Average (mg/L)		BOD <sub>5</sub> Average (mg/L)		Total Susp. Solids Average (mg/L)		Fecal Coliform Average (MPN/100 mL)	
		INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF
01/01	28.9	11.9	12.3	7.0/7.4	7.0/7.2	NA	0.8	NA	6.4	284	156	246	40	NA	25
02/01	27.8	11.6	12.1	7.1/7.5	7.0/7.2	NA	0.8	NA	6.6	248	133	250	37	NA	57
03/01	29.3	11.4	11.5	7.3/7.6	7.0/7.3	NA	0.8	NA	6.8	250	133	267	41	NA	36
04/01	29.7	11.1	11.7	7.0/7.6	6.9/7.4	NA	0.8	NA	6.4	235	142	224	44	NA	29
05/01	27.8	12.3	12.9	7.0/7.5	6.8/7.5	NA	0.8	NA	6.4	230	144	237	45	NA	50
06/01	25.6	13.8	14.3	7.0/7.8	7.0/7.6	NA	0.8	NA	6.1	251	154	253	58	NA	17
07/01	28.4	15.1	15.6	6.9/7.6	6.7/7.3	NA	0.8	NA	5.9	237	145	248	45	NA	32
08/01	26.7	16.0	16.3	7.0/7.4	6.8/7.3	NA	0.7	NA	5.3	244	150	254	40	NA	119
09/01	26.4	16.0	16.2	7.1/7.6	6.9/7.3	NA	0.8	NA	5.2	243	148	253	43	NA	15
10/01	28.1	15.0	15.0	7.1/7.6	6.8/7.5	NA	0.8	NA	6.0	225	134	234	44	NA	26
11/01	27.8	13.6	14.1	7.0/7.6	7.0/7.5	NA	0.8	NA	6.8	229	125	225	61	NA	25
12/01	28.0	12.2	12.3	7.2/7.5	7.0/7.3	NA	0.7	NA	6.6	241	143	223	56	NA	34
<b>Average</b>	27.9	13.3	13.7	6.9/7.8 <sup>a</sup>	6.7/7.6 <sup>a</sup>	---	0.8	---	6.2	243	142	243	46	---	39
<b>Percent Removal</b>		---		---		---		---		42		81		---	

<sup>a</sup> Yearly (minimum-maximum)

NA Not analyzed (effluent only)

--- Not applicable

**Table 9. Toxic Pollutants and Pesticides Detected in the Influent, Effluent, and Sludge, Sampled 19 - 20 June 2001.**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (<math>\mu\text{g/L}</math>)</b>	<b>Effluent<sup>a,b</sup> (<math>\mu\text{g/L}</math>)</b>	<b>Sludge<sup>a</sup> (<math>\mu\text{g/g}</math>)</b>	<b>Percent Removal</b>
<b>VOLATILES (EPA Methods 624/8260B)</b>				
Benzene	ND(0.20)	1.62	ND(0.134)	-710
Chloroform	3.17	2.98	ND(0.134)	6
1,4-Dichlorobenzene	ND(2.00)	ND(2.00)	0.303	---
Ethylbenzene	0.55	ND(0.20)	ND(0.134)	64
Tetrachloroethene	2.91	2.16	0.233	26
Toluene	6.41	9.37	0.741	-46
m,p-Xylene	1.91	1.67	0.333	13
o-Xylene	0.95	0.75	0.137	21
<b>VOLATILES (EPA Method 602)</b>				
Benzene	ND(0.50)	[ND(0.50)/ ND(0.50)] /ND(0.50)	NT	---
Ethylbenzene	ND(0.50)	[ND(0.50)/ND(0.50)]/ ND(0.50)	NT	---
Toluene	3.8	[4.2/4.0]/ 4.2	NT	[-11/-5]/-11
Xylenes	1.4	[ND(0.50)/ND(0.50)] /ND(0.50)	NT	[64/64]/64
1,2-Dichlorobenzene	7.1	[6.2/5.6]/6.0	NT	[13/21]/15
1,3-Dichlorobenzene	1.3	[4.5/4.4]/4.6	NT	[-246/-238]/-254]
1,4-Dichlorobenzene	1.1	[1.1/1.1]/1.1	NT	[0/0]/0
<b>SEMI-VOLATILES (EPA Methods 625/8270C)</b>				
Benzoic acid	121 E	ND(52.6)	ND(59.4)	57
Bis (2-ethylhexyl) phthalate	34.0	22.9	40.0	33
Phenol	42.0	ND(10.5)	ND(11.9)	75
<b>HYDROCARBONS</b>				
Oil & Grease (EPA 1664-HEM)	58100	21200	NT	64
Total Aromatic Hydrocarbons as BETX from EPA Method 602	6.2	[5.7/5.5]/5.7	NT	[8/11]/8
Total Aromatic Hydrocarbons as BETX from EPA Method 624	10.02	13.61	1.5	-36

**Table 9. Toxic Pollutants and Pesticides Detected in the Influent, Effluent, and Sludge, Sampled 19 - 20 June 2001. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (<math>\mu\text{g/L}</math>)</b>	<b>Effluent<sup>a,b</sup> (<math>\mu\text{g/L}</math>)</b>	<b>Sludge<sup>a</sup> (<math>\mu\text{g/g}</math>)</b>	<b>Percent Removal</b>
<b>DISSOLVED METALS</b>				
Antimony	ND(10)	ND(10)	NT	---
Arsenic	ND(3)	ND(3)	NT	---
Beryllium	ND(0.03)	ND(0.03)	NT	---
Cadmium	ND(0.1)	ND(0.1)	NT	---
Chromium	1.7	0.6	NT	65
Copper	12	28	NT	-133
Lead	6	3	NT	50
Mercury	ND(0.1)	ND(0.1)	NT	---
Nickel	4	4	NT	0
Selenium	ND(10)	ND(10)	NT	---
Silver	3.1	1.5	NT	52
Thallium	ND(10)	ND(10)	NT	---
Zinc	20	20	NT	0
<b>TOTAL METALS</b>				
Antimony	ND(10)	ND(10)	1.8	---
Arsenic	3	ND( 3)	2.9	0
Beryllium	0.06	ND(0.03)	0.12	50
Cadmium	0.5	0.3	2.0	40
Chromium	5.6	4.1	21.6	27
Copper	88	56	280	36
Lead	10	6	26.1	40
Mercury	0.4	0.2	1.0	50
Nickel	6	3	15.3	50
Selenium	ND(10)	ND(10)	0.77	---
Silver	12.8	10.7	25.3	16
Thallium	ND(10)	ND(10)	ND(0.30)	---
Zinc	130	70	569	46

**Table 9. Toxic Pollutants and Pesticides Detected in the Influent, Effluent, and Sludge, Sampled 19 - 20 June 2001. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (<math>\mu\text{g/L}</math>)</b>	<b>Effluent<sup>a,b</sup> (<math>\mu\text{g/L}</math>)</b>	<b>Sludge<sup>a</sup> (<math>\mu\text{g/g}</math>)</b>	<b>Percent Removal</b>
<b>PESTICIDES (EPA Methods 608/8081, 614/8141A)</b>				
beta-BHC	ND(0.05)	ND(0.05)/[ND(0.05)/ ND(0.05)]	0.038	---
4,4'-DDT	ND(0.02)	ND(0.02)/[ ND(0.02)/ ND(0.02)]	0.019	---
4,4'-DDE	0.06	0.04/ [ND(0.02)/ND(0.02)]	ND(0.0095)	33/[67/67]
<b>ENTEROCOCCI BACTERIA (SM 9230B)</b>				
Enterococci <sup>c</sup>	NT	>2419.2/>2419.2	NT	
<b>OTHER COMPONENTS</b>				
Asbestos <sup>d</sup>	86	20	ND	77
Cyanide	ND (10)	ND (10)	ND(0.2)	---
Dioxin (2,3,7,8-TCDD )	ND(0.00032)	ND(0.00029)	ND(0.00021)/ ND(0.00021)	---

*a* Detection limits are included in parentheses for non-detected (ND) values

*b* Duplicate field sample analysis or duplicate laboratory analysis provided (value/duplicate value)

*c* Enterococci reported in MPN/100 mL

*d* Asbestos reported in million fibers/L (influent and effluent) and present or none detected (sludge)

E Estimated value

--- Not applicable (not calculated)

ND None detected

NT Not tested

**Table 10. Toxic Pollutants and Pesticides Detected in the Influent, Effluent, and Sludge, Sampled 4 - 5 September 2001.**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a,b</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>VOLATILES (EPA Methods 624/8260B)</b>				
Benzene	3.59	1.99	ND(0.41)	45
Chloroform	2.28	3.60	ND(0.41)	-58
1,4-Dichlorobenzene	1.51	1.27	0.62	16
Ethylbenzene	1.50	2.40	0.298 J	-60
Tetrachloroethene	3.35	2.34	0.314 J	30
Toluene	10.3	8.95	2.15	13
m,p-Xylene	6.21	9.25	1.06	-49
o-Xylene	2.10	3.26	0.347 J	-55
<b>VOLATILES (EPA Method 602)</b>				
Benzene	ND(1.0)	ND(1.0)/ ND(1.0)	NT	---/---
Ethylbenzene	ND(1.0)	ND(1.0)/ ND(1.0)	NT	---/---
Toluene	6.9	8.0/7.7	NT	-16/-12
1,4-Dichlorobenzene	1.7	1.7/1.7	NT	0/0
Xylenes	ND(1.0)	ND(1.0)/ ND(1.0)	NT	---/---
<b>SEMI-VOLATILES (EPA Methods 625/8270C)</b>				
Benzoic Acid	81.6	109	ND(34.1)	-34
Bis (2-ethylhexyl) phthalate	123	272	27.7	-121
Diethylphthalate	11.6	12.6	ND(6.82)	-9
<b>HYDROCARBONS</b>				
Oil & Grease (EPA 1664-HEM)	38600	20400	NT	47
Total Aromatic Hydrocarbons as BTEX from EPA Method 602	9.9	11/10.7	NT	-11/-8
Total Aromatic Hydrocarbons as BTEX from EPA Method 624	23.7	25.8	4.4	-9

**Table 10. Toxic Pollutants and Pesticides Detected in the Influent, Effluent, and Sludge, Sampled 4 - 5 September 2001. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a,b</sup> (µg/L)</b>	<b>Effluent<sup>a,b</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>DISSOLVED METALS</b>				
Antimony	ND(10)	ND(10)/ ND(10)	NT	---
Arsenic	ND(3)	7	NT	-133
Beryllium	ND(0.03)	ND(0.03)	NT	---
Cadmium	ND(0.1)	0.3	NT	-200
Chromium	ND(0.5)	ND(0.5)	NT	---
Copper	21	28	NT	-33
Lead	4	3	NT	25
Mercury	ND(0.1)	ND(0.1)	NT	---
Nickel	5	4	NT	20
Selenium	ND(10)	ND(10)/ ND(10)	NT	---
Silver	2.3	0.9	NT	61
Thallium	ND(10)	ND(10)/ ND(10)	NT	---
Zinc	20	50	NT	-150
<b>TOTAL METALS</b>				
Antimony	ND(10)	ND(10)/ ND(10)	5.7	---/---
Arsenic	4	ND(3)	4.0	25
Beryllium	ND(0.03)	ND(0.03)	0.189	---
Cadmium	0.5	0.3	2.40	40
Chromium	4.1	3.2	16.5	22
Copper	82	39	277	52
Lead	13	6	36.2	54
Mercury	0.4	0.1	0.7	75
Nickel	7	4	15.0	43
Selenium	ND(10)	ND(10)/ ND(10)	3.4	---/---
Silver	10.9	6.0	32.1	45
Thallium	ND(10)	ND(10)/ ND(10)	ND(0.30)	---/---
Zinc	140	60	581	57



**Table 10. Toxic Pollutants and Pesticides Detected in the Influent, Effluent, and Sludge, Sampled 4 - 5 September 2001. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a,b</sup> (µg/L)</b>	<b>Effluent<sup>a,b</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>PESTICIDES (EPA 608/8081, 614/8141A)</b>				
All compounds	ND	ND	ND	---
<b>ENTEROCOCCI BACTERIA (SM 9230B)</b>				
Enterococci <sup>c</sup>	NT	>2419.2/>2419.2	NT	---
<b>OTHER COMPONENTS</b>				
Asbestos <sup>d</sup>	112	13	ND	88
Cyanide	ND(10)	ND(10)	ND(0.2)	---
Dioxin (2,3,7,8-TCDD)	ND(0.00067)	ND(0.00020)	ND(0.00016)	---

*a* Detection limits are included in parentheses for non-detected (ND) values

*b* Duplicate field sample analysis or duplicate laboratory analysis provided (value/duplicate value)

*c* Enterococci reported in MPN/100 mL

*d* Asbestos reported in million fibers/L (influent and effluent) and present or none detected (sludge)

--- Not applicable (not calculated)

ND None detected

NT Not tested

J Estimated value

Percent removal rates shown in these tables were computed from influent and effluent concentration values, with the reporting limit concentration used for pollutants reported as not detected (ND). Percent removal was not calculated when both influent and effluent concentrations were not detected (i.e., when compounds were only detected in sludge samples). Where several laboratory duplicate analyses were performed for a parameter, a percent removal is provided for each duplicate. For summed values, such as the total aromatic hydrocarbons as BETX from Method 602, the detection limit was used for values reported as not detected (ND).

Some of the pollutant removal rates were actually negative values due to the higher concentrations found in the effluent or where a compound was detected in the effluent but not the influent. Both positive and negative removals can be caused by effluent samples being more homogenous due to mixing in the clarifiers, whereas detecting a point-source pollutant in the influent is more haphazard. Also, there is a residence time for the effluent in the plant, along with the addition of approximately 1 million gallons/day of well water and city water in the treatment process, therefore the influent does not correspond directly with the effluent. .

Oil and grease were measured in the influent and effluent in 2001 using EPA 1664 HEM which has replaced SM 5520B due to the Federal ban on freon. BETX concentrations ranged from approximately 5.5 – 5.7 µg/L in the Summer Dry sampling and around 11 µg/L during the Summer Wet sampling. Oil and grease concentrations were typical of that seen in the past with effluent concentrations were in the range of 20 - 21 mg/L. Total aromatic hydrocarbons as BETX (EPA 602) and PAHs and AHCs were also sampled in the effluent as part of the receiving water program. Refer to Section 5.1 for further discussion of the significance of the total hydrocarbon values.

The AWQS have site-specific criteria for the Point Woronzof area that are based on dissolved metals in the receiving water. These SSWQC were utilized to determine the MAEC (the value specified as the receiving water limit and/or permit limit multiplied by the initial dilution of 142:1 after taking into account the natural background concentration). Both total and dissolved concentrations of metals in the effluent were then compared to the MAECs.

Total metals concentrations were generally found to be low. Effluent concentrations of total antimony, arsenic, beryllium, selenium, and thallium were below detection limits during both sampling periods. Other total metals such as effluent cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc were seen in the effluent during both sampling events, but at very low levels when compared to their respective MAECs.

In addition to the total metals analyses, dissolved metals were determined during the 2001 sampling as required by the permit. Dissolved metals concentrations for antimony, beryllium, mercury, selenium, and thallium were found to be below detection limits for both sampling periods. Dissolved chromium was reported at low levels during the June sampling period but was below detection limits in the September sampling, while dissolved cadmium was above detection limits only during the September sampling. The concentration for dissolved copper was found to be the highest of any of the metals with respect to its MAEC of 317 µg/L, but still an order of magnitude less than that limit. Other dissolved metals were detected, but at very low levels with respect to their MAECs. The concentrations of cyanide in influent and effluent were less than the detection limit of 10 µg/L during both the June and September 2001 sampling events. The MAEC for cyanide is 143 µg/L.

The types and concentrations of measured organic compounds varied considerably between the two sampling periods. Compounds that were detected in both the influent and effluent samples during at least one of the sampling events included benzene, benzoic acid, bis(2-ethylhexyl)phthalate; 1,2-, 1,3-, and 1,4-dichlorobenzene; diethylphthalate, chloroform; ethylbenzene; tetrachloroethene; xylenes, and toluene. Chloroform was also detected in the trip blank sample for June 2001, but not in the field blank for this sampling. Phenol was found in the influent during the June 2001 sampling event. With the exception of 1,4-dichlorobenzene, tetrachloroethene, toluene and xylenes, and bis(2-ethylhexyl)phthalate, these compounds were not detected in the sludge during the June 2001 sampling. Toluene, xylenes, bis(2-ethylhexyl)phthalate, and 1,4-dichlorobenzene were detected in the sludge during the September 2001 sampling. Ethylbenzene, tetrachloroethene, and *o*-xylene were also reported as estimates in the September 2001 sludge samples.

The only pesticide that was detected in the influent or effluent was 4,4'-DDE, which was detected in the June 2001 influent and effluent samples. Sludge samples were found to contain beta-BHC and 4,4'-DDT during the June 2001 sampling event. No pesticides were detected in the influent, effluent, or sludge during the September 2001 sampling event. For a complete list of the various pesticide analytes, refer to Appendices A2 and B2.

Asbestos was detected in influent and effluent but not in the sludge during both sampling events. Dioxin (2,3,7,8-TCDD) was tested in influent, effluent, and sludge during both sampling events, but none was detected.

The permit calls for the analysis of enterococci bacteria in effluent twice per year in conjunction with the Summer Dry and Summer Wet sampling. The enterococci in the effluent was reported as >2419.2 MPN/100 mL for both of the replicates taken during each of the sampling events.

### **3.1.3 Pretreatment Monitoring Data**

As part of the NPDES permit, AWWU is to conduct pretreatment monitoring twice per year in conjunction with the toxic pollutant and pesticide analyses. This monitoring includes three consecutive days of 24-hr composite sampling of the influent and effluent. Pretreatment analyses include cyanide and a suite of metals that are analyzed as both total and dissolved. Results of the pretreatment monitoring are presented in Table 11.

Metals concentrations for the first day of the pretreatment sampling were already discussed in Section 3.1.2 as part of the toxic pollutant and pesticide analyses. Metals concentrations for the two subsequent days were typically similar to those seen on the first day of sampling, particularly for the effluent. Influent values were somewhat more variable, as would be expected. Of all the metals, the dissolved copper and zinc concentrations in the effluent were the highest but were still at least an order of magnitude less than their respective MAECs. Dissolved copper in the effluent was found to range from 28 to 42 µg/L for the six samples compared to the MAEC of 317 µg/L. June 2001 effluent samples ranged from 28 – 42 µg/L in dissolved copper, while September 2001 effluent samples were somewhat lower and less variable with a range of 28 – 31 µg/L. Dissolved zinc in the effluent ranged from 20 – 50 µg/L during both June 2001 and September 2001 compared to an MAEC of 11,249 µg/L. Dissolved mercury was measured at <0.1 µg/L all six effluent samples compared to its MAEC of 2.72

**Table 11. Pretreatment Monitoring Data for Metals and Cyanide.** Concentrations are in µg/L.

Parameter	June						August					
	Influent			Effluent			Influent			Effluent		
Sample Date	19	20	21	19	20	21	4	5	6	4	5	6
<b>Dissolved Metals</b>												
Arsenic	<3	<3	<3	<3	<3	<3	<3	<3	3	7	<3	3
Beryllium*	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cadmium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.1	0.3	0.2	0.2
Chromium	1.7	1.1	1.2	0.6	0.8	2.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper	12	20	20	28	40	42	21	23	17	28	31	29
Cyanide	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Lead	6	4	6	3	4	7	4	10	17	3	4	1
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	4	3	<1	4	3	<1	5	13	4	4	5	4
Silver	3.1	3.2	3.3	1.5	1.5	2.0	2.3	2.0	1.7	0.9	0.9	0.6
Zinc	20	<20	<20	20	50	20	20	20	20	50	30	20
<b>Total Metals</b>												
Arsenic	3	<3	5	<3	3	3	4	4	4	<3	3	3
Beryllium*	0.06	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cadmium	0.5	0.5	0.4	0.3	0.2	0.3	0.5	0.7	0.7	0.3	1.0	0.3
Chromium	5.6	4.4	5.6	4.1	3.0	3.7	4.1	6.2	3.4	3.2	3.5	3.4
Copper	88	84	84	56	54	54	82	82	83	39	42	41
Cyanide	<10	<10	<10	<10	<10	<10	<10 <sup>a</sup>	<10 <sup>a</sup>	<10 <sup>a</sup>	<10 <sup>a</sup>	<10 <sup>a</sup>	<10 <sup>a</sup>
Lead	10	13	27	6	5	19	13	13	8	6	6	4
Mercury	0.4	0.3	0.3	0.2	0.2	0.1	0.4	0.2	0.2	0.1	<0.1	<0.1
Nickel	6	6	4	3	3	3	7	8	10	4	6	5
Silver	12.8	10.6	12.9	10.7	7.3	7.0	10.9	10.9	10.2	6.0	6.9	5.5
Zinc	130	150	130	70	80	80	140	150	140	60	70	60

<sup>a</sup> August cyanide failed QC; it was rescheduled and performed November 19, 20 & 21

\* Not required by permit

NT Not tested

µg/L. Other metals were found to be substantially less than their respective MAECs. Cyanide was below detection limits (<10 µg/L) in all six effluent samples compared to an MAEC of 143 µg/L.

### 3.1.4 Whole Effluent Toxicity Testing Results

Quarterly WET testing was conducted on 24-hr flow composite effluent samples as required under the permit during all four quarters of calendar year 2001. During the first quarter of 2001, WET testing was performed using one vertebrate and two invertebrate species to continue the screening process for the most sensitive species. The vertebrate test was a 72-hr survival and growth bioassay on a topsmelt, *Atherinops affinis*. The invertebrate tests included a 48-hr survival and development test on a bivalve mussel, *Mytilus galloprovincialis*, and a 24-hr echinoderm fertilization test on a purple sea urchin, *Strongylocentrotus purpuratus*. Of the three test species, the bivalve *Mytilus galloprovincialis* was found to be the most sensitive when the first three quarterly tests results were reviewed together. Since the NPDES permit requires quarterly WET testing to continue on the most sensitive species after the first three suites of tests with an annual rescreening of all three species, WET testing performed in the last three quarters of 2001 utilized only the bivalve survival and development test.

Results of all the tests performed in 2001 are summarized below and presented in Table 12 as the lowest observed effect concentration (LOEC), no observed effect concentration (NOEC), and in chronic toxicity units (TUc), where TUc = 100/NOEC. Detailed results in the form of descriptive laboratory reports that present all data in tabular form along with statistical analyses, QA/QC information, and reference toxicant tests are presented in Appendix C.

**Table 12. Summary of WET Test Data from 2001.**

Toxicity Test	LOEC (%)	NOEC (%)	TUc
<b>1<sup>st</sup> Quarter 2001 WET Tests</b>			
Topsmelt (survival)	>2.8	2.8	<35.7
Topsmelt (growth)	>2.8	2.8	<35.7
Bivalve (survival)	>2.8	2.8	<35.7
Bivalve (development)	>2.8	2.8	<35.7
<b>Echinoderm (fertilization)</b>	<b>2.8</b>	<b>1.4</b>	<b>71.4</b>
<b>2<sup>nd</sup> Quarter 2001 WET Tests</b>			
Bivalve (survival)	>2.8	2.8	<35.7
Bivalve (development)	>2.8	2.8	<35.7
<b>3<sup>rd</sup> Quarter 2001 WET Tests</b>			
Bivalve (survival)	>2.8	2.8	<35.7
<b>Bivalve (development)</b>	<b>2.8</b>	<b>1.4</b>	<b>71.4</b>
<b>4<sup>th</sup> Quarter 2001 WET Tests</b>			
Bivalve (survival)	>2.8	2.8	<35.7
Bivalve (development)	>2.8	2.8	<35.7

*Bolded values indicate statistically significant results indicating chronic toxicity.*

First quarter 2001 WET testing was performed on samples collected during January. Bivalve and echinoderm testing was performed on a single 24-hr composite sample collected from 7–8 January 2001. Due to a laboratory control problem, the topsmelt testing for this sampling event needed to be repeated, and topsmelt testing was performed on three effluent samples collected 21–22, 23–24, and 25–26 January 2001. Second quarter testing for bivalve survival and development was performed on an effluent sample collected 9 - 10 April 2001. Third quarter WET testing was performed on a sample collected between 17 - 18 September 2001, and fourth quarter sampling was conducted on a sample collected from 5 - 6 November 2001.

Results of the first quarter 2001 topsmelt bioassays showed that no concentration of effluent tested produced significant mortality or significant decreased growth of topsmelt larvae when compared to the controls. All test validity criteria were met and reference toxicant tests were within laboratory control chart limits which indicate typical sensitivity of the test populations for this test.

Results of the echinoderm fertilization bioassay performed during the first quarter of 2001 showed that the 2.8 % effluent concentrations produced a significant decrease in egg fertilization when compared to the controls. The NOEC for fertilization was 1.4 %, the LOEC was 2.8 %, and the TUC was 71.4 compared to a permit maximum of 143 TUC which would trigger additional testing requirements. All test validity criteria were met and reference toxicant tests were within laboratory control chart limits which indicate typical sensitivity of the test populations for both tests. This was the first echinoderm test performed to date for the program that showed toxicity, indicating some sensitivity of this species to the effluent; however, prior tests performed in the last two quarters of 2000 resulted in no significantly reduced egg fertilization.

The results of the bivalve mussel larvae bioassays performed in the second, third, and fourth quarters showed that no effluent concentrations tested resulted in statistically significant reduced survival or normal development of the test organisms. Results reported for these tests showed an LOEC of >2.8 %, an NOEC of 2.8 %, and a TUC of <35.7 for both survival and development. Survival results for the third quarter were similar, with no reduction in bivalve survival shown in the test. However, development data for the third quarter differed in that the highest effluent concentration tested did result in significantly reduced normal development of the test organisms. The NOEC for normal development was 1.4 %, while the LOEC was 2.8 %. The TUC for development was reported at 71.4 compared to a permit maximum of 143. Test results indicated that the toxicity seen in the development data was a statistical artifact of a data set with extremely low variance, with highly developed larvae (>95 % normal) and good survival (>97 %) at the 2.8 % effluent concentration, indicating the effluent contained nominal chronic toxicity. All test validity criteria were met and reference toxicant test results were within laboratory control chart limits for all the bivalve bioassays, indicating valid tests and typical sensitivity for the test populations.

### **3.1.5 Part 503 Sludge Monitoring Data**

The AWWU operates a sludge incinerator at the Asplund WPCF for which the NPDES permit requires sludge monitoring twice per year as part of the "Toxic Pollutants and Pesticides/Pretreatment" sampling requirements. As described in Section 2.1.5, AWWU performed Part 503 sludge monitoring with a minimum frequency of once every two months. These data will be submitted along with other incinerator operational information to

EPA by 19 February 2002. This submittal will take the form of a separate report; however, for completeness and for comparison purposes, this information has been included here also.

Results of the sludge monitoring for metals for the year are presented in Table 13. Metals concentrations were extremely low compared to allowable limits and very similar to those seen historically. The only metal that had historically been elevated for some sampling events was arsenic. In 2001, the highest concentration of arsenic in the sludge was 4.0 mg/kg compared to the allowable limit of 95.8 mg/kg. As mentioned above, no permit limits exist in the reissued NPDES permit. Allowable limits are site-specific and were calculated per Part 503 regulations in the *Air Operating Permit Application* submitted by AWWU to the ADEC in December 1997 (CH2M Hill, 1987).

## **3.2 RECEIVING WATER QUALITY MONITORING RESULTS**

Water quality sampling of the receiving water was conducted on 19 – 20 June 2001, concurrent with the Summer Dry sampling. Sampling results are contained in the following subsections.

### **3.2.1 Plume Dispersion Sampling**

#### **Drogue Tracking Results**

Drogues were released on 19 June 2001 at the effluent ZID station for the ebb and flood tidal cycles and on 20 June 2001 at the control station for the flood tidal cycle. Three drogues were deployed during each tidal cycle.

#### **ZID Site**

The Point Woronzof ebb drogue drop and tracking cycles were performed on the morning and early afternoon of 19 June 2001. The tidal range during ebb stage was 29.8 feet (Figure 5 and Table 14; Micronautics, Inc. Tide 1: Rise and Fall®, 2001). A composite of the ebb drogue deployments is depicted in Figure 6.

All three of the ebb drogues traveled one to two nautical miles in a southwesterly direction. No eddies were observed during these drogue drops. The first drogue tracked more southerly along the shoreline and south of the shoal that is evident at low water approximately one mile southwest of Point Woronzof. The second ebb drogue tracked directly over the shoal, and the third drogue tracked similar to the second drogue track towards the shoal. The first ebb drogue (E1) was released at 08:18 Alaska Daylight Time (ADT), approximately 2¼ hours after high slack water, and traveled at an average speed of 88 centimeters per second (cm/s). The second ebb drogue (E2) was released at 09:46 ADT, almost four hours after high tide, and tracked until recovery at 11:01 ADT. The average speed for the second drogue was 95 cm/s. The third drogue (E3) was released at 11:17 ADT, over five hours after the high tide, and tracked until 12:30 ADT. The average speed of this drogue was 52 cm/s.

**Table 13. Part 503 Discharge Monitoring Data for Sludge Metals.** Concentrations are in mg/kg dry weight. All metals are reported as total metals.

Parameter	Lead	Arsenic	Cadmium	Chromium	Nickel	Beryllium	Mercury
MDL	0.2	0.5	0.8/0.02 <sup>5)</sup>	2/0.1 <sup>5)</sup>	3/0.3 <sup>5)</sup>	0.02	0.1
Permit Limit <sup>2)</sup>	7,707	95.8	66.6	2,466	102,764	500 <sup>3)</sup>	9.63 <sup>4)</sup>
02/11/01	39	2.5	3.4	18	18	0.12	0.5
04/25/01	26	2.7	3.2	18	19	0.14	2.0
06/19/01	26	2.9	2.0	22	15	0.12	1.0
08/29/01	39	3.2	2.6	17	17	0.21	1.0
09/04/01	36	4.0	2.4	17	15	0.19	0.7
11/02/01	91	3.1	2.1	12	15	0.15	1.3
12/04/01	40	3.0	2.5	15	18	0.15	1.0
MIN	26	2.5	2.0	12	15	0.12	0.5
MAX	91	4.0	3.4	22	19	0.21	2.0
AVE	43	3.1	2.6	17	17	0.15	1.1

**Footnotes:**

- 1) EPA = Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, EPA.  
Samples for total metals analysis, with the exception of mercury, were prepared according to EPA method 3050A, SW-846.
- 2) Permit Allowable Limits calculated in Air Operating Permit Application submitted to Alaska Department of Environmental Conservation, December 1997.
- 3) Beryllium emissions shall not exceed 10 grams per day. With a control efficiency of 0.9998 at the maximum sludge feed rate, a sludge concentration of 500 milligrams per dry kilogram of sludge will not result in a violation of the limit.
- 4) Mercury emissions shall not exceed 3,200 grams per day. With a control efficiency of 0.0 at the maximum sludge feed rate, a sludge concentration of 9.63 milligrams per dry kilogram of sludge will not result in a violation of the limit.
- 5) Cadmium, chromium, and nickel samples collected 6/19/01, 8/29/01, 9/4/01 analyzed by furnace method.
- 6) Monitoring frequencies required by 40 CFR Part 503 for incineration are once per 60 days for arsenic, cadmium, chromium, lead, and nickel. Mercury is at least once per year. Frequency for beryllium is not specified. AWWU has chosen to test mercury and beryllium more frequently than required to be consistent with the other metals.



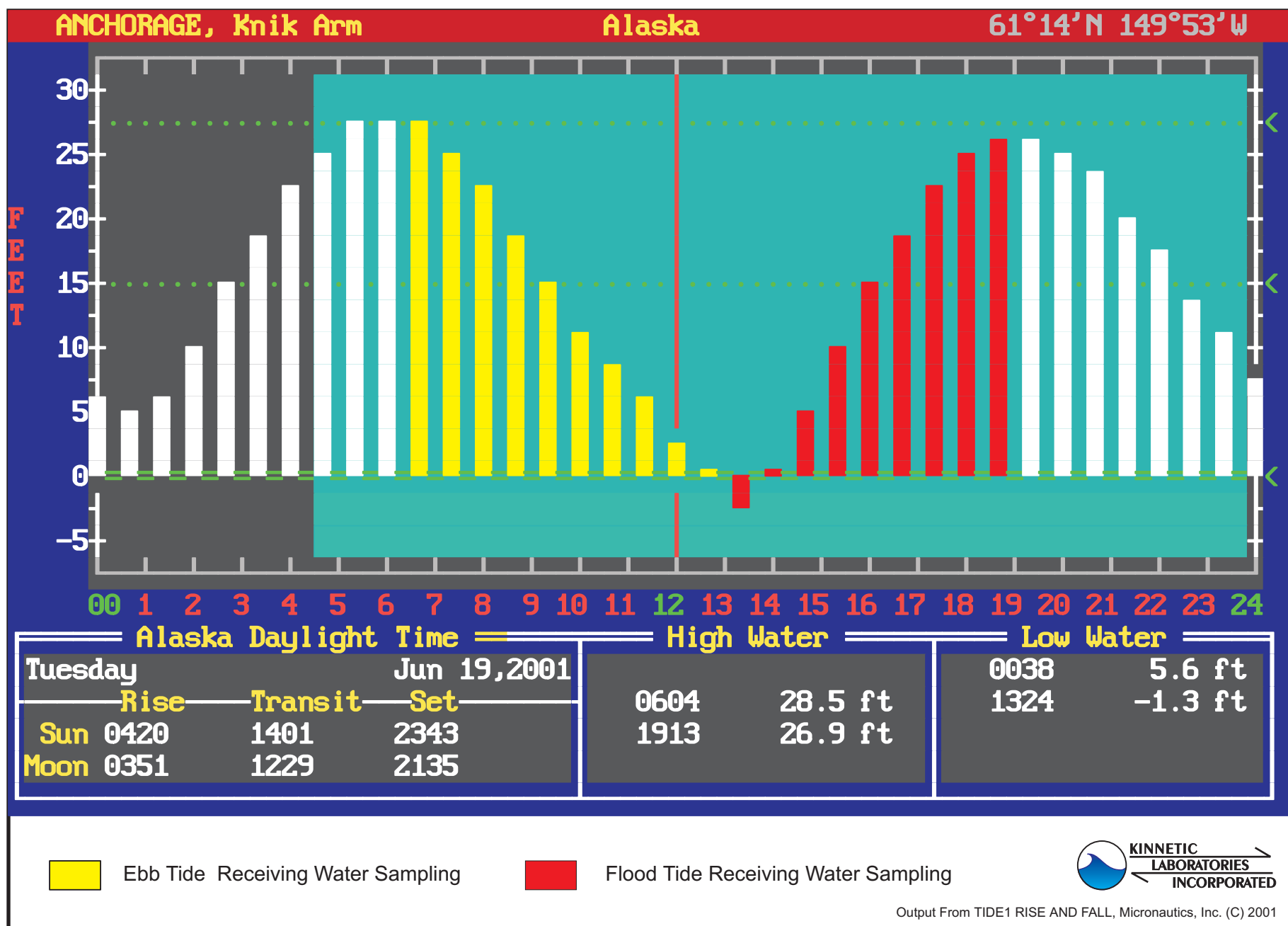


Figure 5. Tidal Information for Receiving Water Sampling, Ebb and Flood Tides.

**Table 14. 2001 Drogue Tracking Information.**

Date	Station	Tidal Information				Drogue No.	Release Time After Slack (Hours:Minutes)	Drogue Speed (cm/s)
		Slack Water (Alaska Daylight Time <sup>a</sup> ; Stage)		Direction	Range (Feet) <sup>b</sup>			
19 June 2001	ZID	06:04	HIGH	EBB	29.8	E1	2:14	88
19 June 2001	ZID	06:04	HIGH	EBB	29.8	E2	3:42	95
19 June 2001	ZID	06:04	HIGH	EBB	29.8	E3	5:13	52
19 June 2001	ZID	13:24	LOW	FLOOD	28.2	F1	0:03	44
19 June 2001	ZID	13:24	LOW	FLOOD	28.2	F2	1:51	40
19 June 2001	ZID	13:24	LOW	FLOOD	28.2	F3	3:33	120
20 June 2001	CONTROL	14:10	LOW	FLOOD	30.1	C1	0:10	95
20 June 2001	CONTROL	14:10	LOW	FLOOD	30.1	C2	2:00	222
20 June 2001	CONTROL	14:10	LOW	FLOOD	30.1	C3	4:31	136

*a* Tidel: Rise and Fall<sup>®</sup>, Micronautics, Inc. 2001. (Knik Arm, Anchorage)

*b* Predicted water level variations during tide.

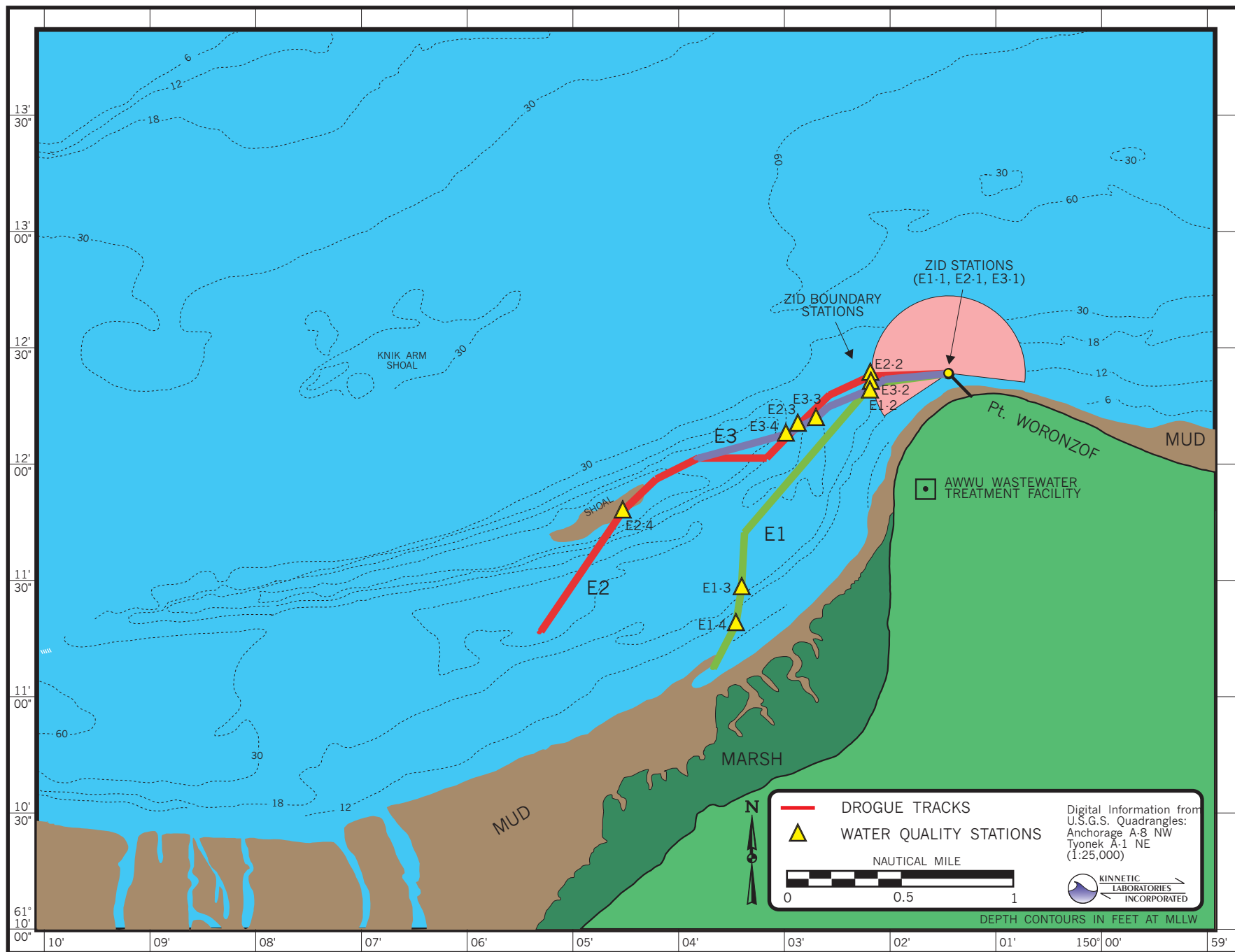


Figure 6. Summary of Ebb Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 19 June 2001.

Flood drogue tracks are depicted in Figure 7. The first flood drogue (F1) was deployed on 19 June at 13:21 ADT at low slack water at the outfall and tracked until 14:50 ADT, at which point it was recovered. This drogue traveled easterly along the shoreline on the lee side of Point Woronzof. The drogue traveled for approximately one nautical mile at an average speed of 44 cm/s. In the past, the first drogue has often encountered a clockwise eddy in the lee of Point Woronzof bringing it back towards shore. This eddy was not evident in 2001, however, the drogue did travel close to the shoreline.

The second flood drogue (F2) was deployed at 15:15 ADT, almost 2 hours after low slack, and tracked until it was recovered at 16:35 ADT. The second drogue was transported to the east and slowly looped back towards the shoreline approximately one nautical mile from its release point. The drogue track formed a small clockwise loop that is probably the result of the eddy that often forms on the flood tide in the lee of Point Woronzof. The second drogue had an average speed of 40 cm/s.

The third flood drogue (F3) was deployed at 16:57 ADT, 3 ½ hours after high slack water, and tracked for about two hours until recovery at 18:54 ADT. The third drogue traveled in a northeast direction further out from the shoreline with an average speed of 120 cm/s. The third drogue was tracked for five nautical miles to the northeast and was recovered one mile offshore and to the west of the Port of Anchorage.

### **Control Site**

The Point MacKenzie control drogues were deployed and tracked on 20 June 2001. The predicted tidal range during the flood tide was 30.1 ft. Tidal information is provided in Figure 8 and Table 14 (Micronautics, Inc. Tide 1: Rise and Fall®, 2001). A composite of the three drogue trajectories is presented in Figure 9.

All three control drogues had similar tracks with the first drogue (C1) tracking closer to shore. The first drogue was released at 14:20 ADT, 10 minutes after slack water, and recovered at 15:55 ADT. The first drogue traveled northeast parallel to and approximately ½ mile from the shoreline. The average speed of this drogue over the entire track was 95 cm/s. The second drogue (C2) was released at 16:10 ADT, two hours into the flood tidal cycle, and tracked until recovery at 17:38 ADT. This drogue had an average speed of 222 cm/s over the entire track and moved towards the northwest offshore of the first drogue and then northerly after passing Cairn Point. The third control drogue (C3) was released at 18:41 ADT, 4½ hours after high slack water. The drogue traveled northeast into the central channel with an average speed of 136 cm/s. The drogue was recovered at approximately 1½ hours after release in mid-channel west of Cairn Point.

### **Summary of Water Quality Data**

The summer water quality sampling for all analysis types was conducted concurrently with the drogue tracking studies on 19 and 20 June 2001. As discussed previously, three drogues were released per tidal cycle at the ZID for both ebb and flood tides and three at the control site for the flood tide only. Water samples and CTD measurements were to be obtained at four stations along each drogue's track prior to its grounding. In the current NPDES permit, the ZID boundary was located 650 m distance from the outfall diffuser. To accomplish the ZID site

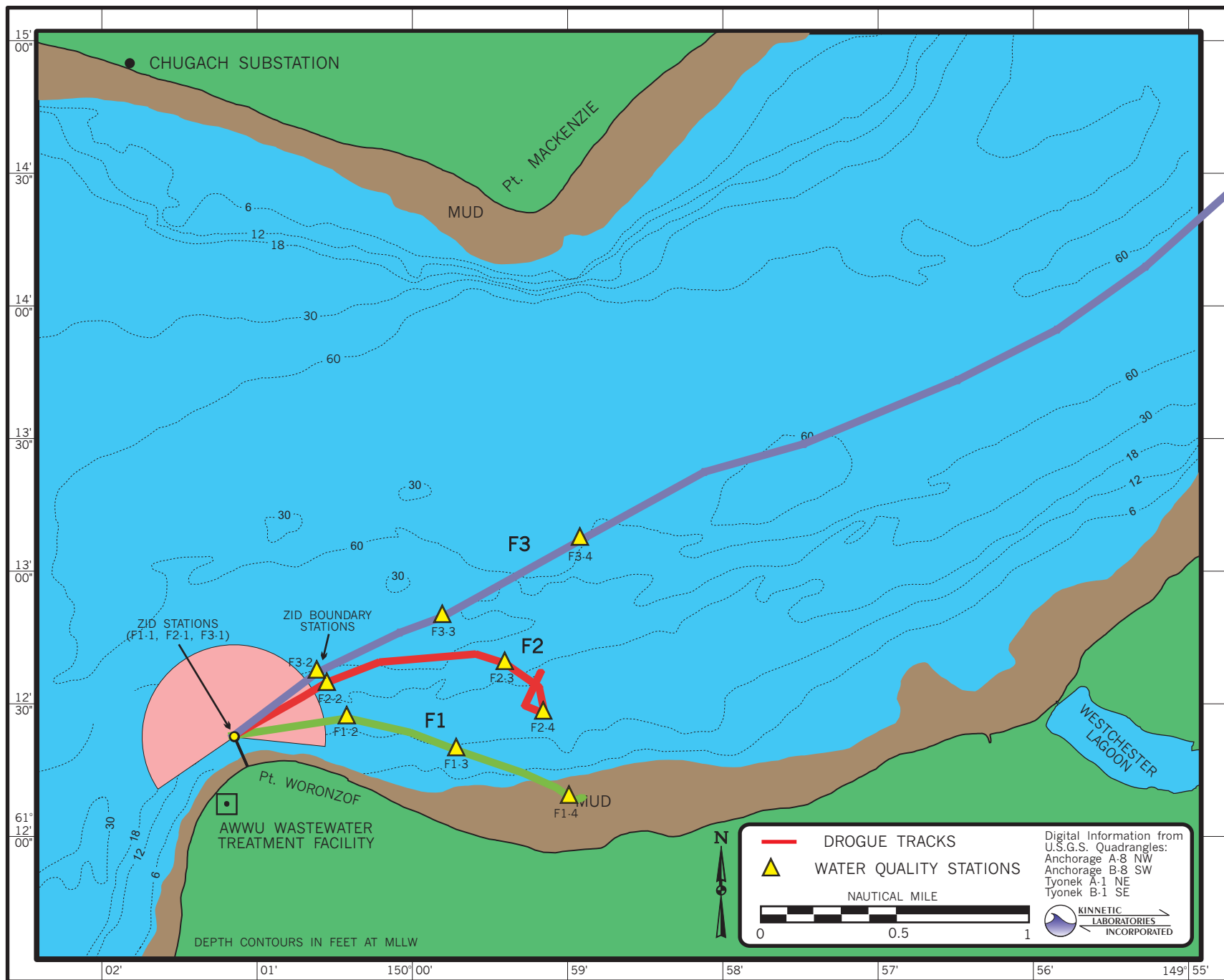


Figure 7. Summary of Flood Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 19 June 2001.

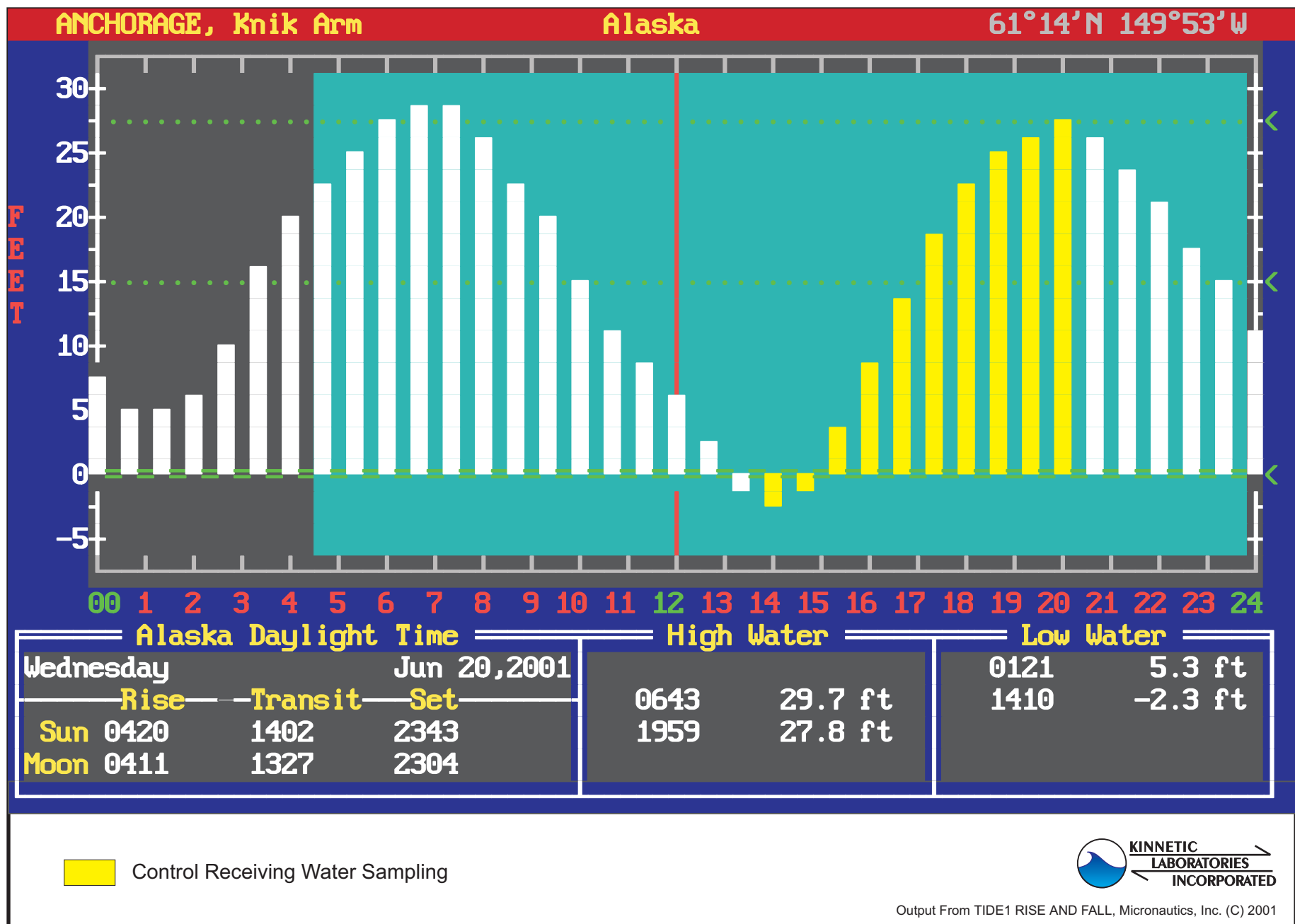


Figure 8. Tidal Information for Receiving Water Sampling, Control Tides.

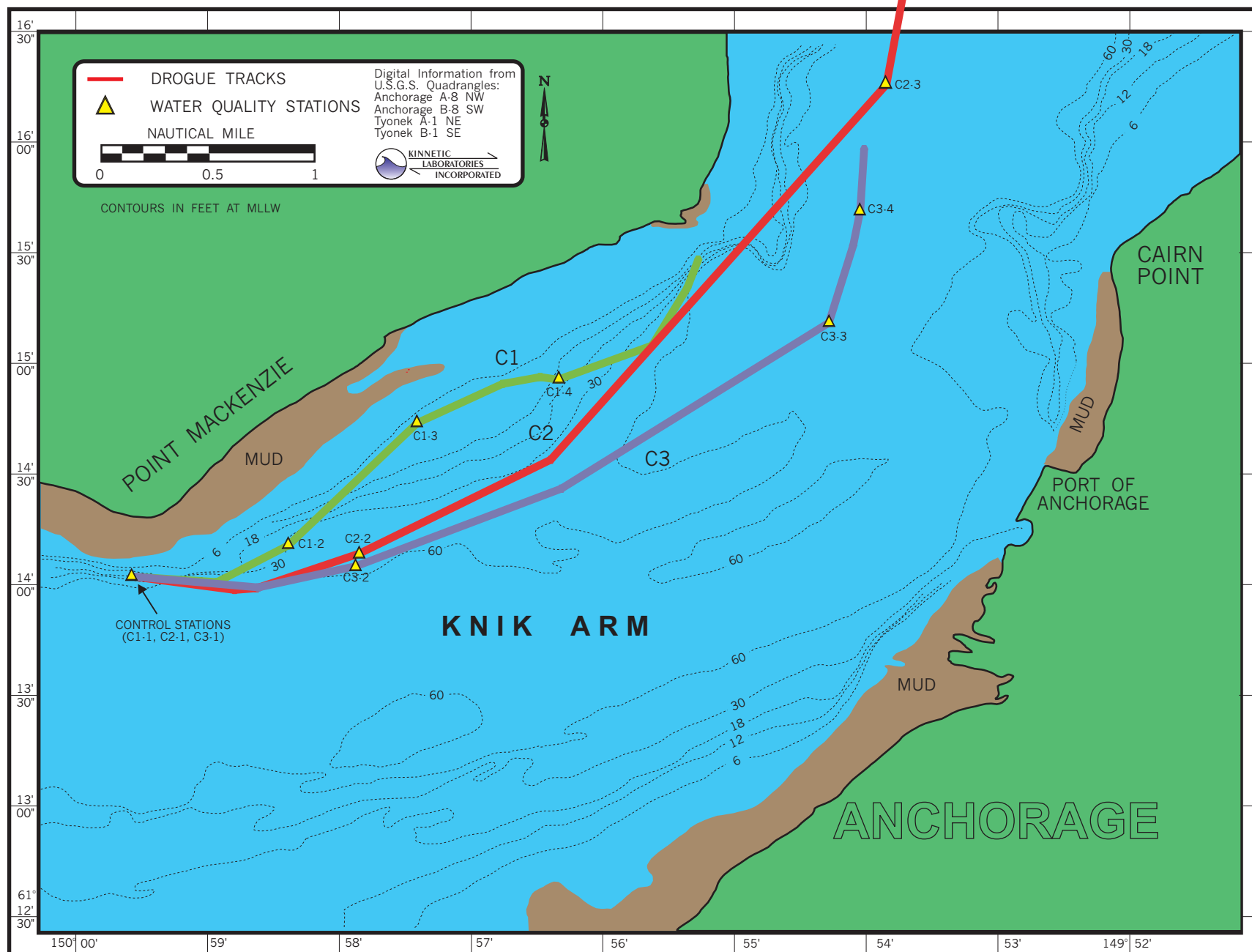


Figure 9. Summary of Control Drogue Tracks and Receiving Water Sampling Locations at Point MacKenzie, 20 June 2001.

sampling, the vessel was positioned directly upcurrent from the diffuser and allowed to drift down across it. Upon reaching the outfall diffuser, the drogue was dropped and the within-ZID station sampled. The distance from the outfall diffuser was monitored with the DGPS, and upon reaching 650 m distance from the diffuser, the ZID-boundary station was sampled. The third and fourth stations were then sampled along the drogue's path. Due to high current speeds, anchoring the vessel and sampling at each station was not practical or desirable for this type of sampling.

Table 15 provides a summary of the water quality measurements obtained, where the station designation is represented by: drogue drop location (C=control, E=ebb, and F=flood), the first number represents the drogue number, and the second number represents the station along the drogue's path. The final character represents a surface (S), mid-depth (M), or bottom (B) sample.

The waters of the inlet are extremely well-mixed both vertically and horizontally, as indicated by the CTD data. During the survey, temperatures ranged from a minimum of 13.00° C to a maximum of 14.88° C. Salinities were found to vary from a minimum of 4.05 parts per thousand (ppt) to a maximum of 14.28 ppt. Salinities were generally found to increase slightly during the flood and decrease on the ebb, as is typical for estuaries. The control stations across the inlet were found to be slightly warmer and less saline due to a greater influence from river runoff. Little variation was seen in the dissolved oxygen concentrations obtained from Winkler titrations. Values for DO ranged from 9.02 to 9.55 mg/L.

Values for pH ranged from 7.67 to 8.15 with no vertical stratification. Turbidity values for water samples collected during the monitoring ranged from a low of 21 Nephelometric Turbidity Units (NTU) to a high of 391 NTU.

Representative hydrographic profiles of water quality are presented for the second control drogue drop, Station C2-1, and the nearfield station on the first ebb drogue, Station E1-1 (Figure 10). The water column was found to be generally well-mixed from the surface to the bottom at all stations. Refer to Appendix D5 for hydrographic profile plots from each water quality station.

Dissolved oxygen data were collected in-situ by the CTD as well as by performing the Winkler titration on water samples collected using the Niskin bottles. The DO results tabulated and summarized in the body of this report were those obtained from Winkler analysis. The DO concentrations obtained from in situ measurements were more variable and felt to be less accurate so were not utilized for this report, but they are presented with the hydrographic profile data in Appendix D5.

Surface samples were obtained at each station for the analysis of color, TRC, and fecal coliform bacteria. Color values ranged from 10 to 20 color units on the platinum-cobalt scale. The maximum of 20 color units was seen once at three ebb stations, E1-1, E2-4, and E3-1, and at one flood station, F1-2; other values were all at or below 15 color units.

Except for three stations, all TRC concentrations were at or below the detection limit of 0.005 mg/L. TRC was detected at Stations E2-2, E2-4, and F1-1. It should be noted that the method detection limit achievable for TRC analysis is higher than the State-specified limit of 0.002 mg/L (for salmonid fish). The average TRC concentrations of the effluent as reported in the Monthly Monitoring Report for the sampling dates 19 and 20 June 2001 were 0.7 and 0.6 mg/L, respectively. The effluent TRC grab obtained at the same time as the effluent grab sampling was 1.3 mg/L.



**Table 15. Hydrographic and Water Quality Data, 19 and 20 June 2001.**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
<b>JUNE 19</b>												
E1-1S	0818	61° 12' 20.5"	150° 01' 16.7"	0.5	13.36	14.18	7.69	9.25	110	20.0	<0.005	2.0
-1M				7.0	13.54	14.11	7.88	9.50	165			
-1B				14.5	13.55	14.11	7.88	9.19	90			
E1-2S	0832	61° 12' 17.9"	150° 01' 00.1"	0.5	13.00	8.06	7.67	9.14	175	10.0	<0.005	2.0
-2M				7.0	13.55	14.13	7.87	9.30	148			
-2B				14.5	13.55	14.07	7.86	9.30	134			
E1-3S	0853	61° 11' 25.5"	150° 03' 14.2"	0.5	13.30	7.71	7.83	9.26	140	10.0	<0.005	4.0
-3M				2.0	13.54	14.06	7.88	9.28	136			
-3B				3.5	13.54	14.06	7.88	9.24	163			
E1-4S	0910	61° 11' 16.5"	150° 03' 17.5"	0.5	13.40	14.16	7.89	9.21	127	15.0	<0.005	4.0
-4M				4.5	13.54	14.11	7.90	9.20	150			
-4B				8.5	13.54	14.09	7.91	9.20	169			
E2-1S	0946	61° 12' 20.5"	150° 01' 18.0"	0.5	13.39	13.79	7.89	9.31	162	10.0	<0.005	<2.0
-1M				4.0	13.62	13.71	7.90	9.22	168			
-1B				8.0	13.63	13.71	7.91	9.25	152			
E2-2S	0954	61° 12' 19.8"	150° 02' 01.4 "	0.5	13.32	6.33	7.82	9.38	154	10.0	0.0080	<2.0
-2M				6.5	13.64	13.62	7.91	9.36	148			
-2B				12.5	13.64	13.61	7.92	9.38	164			
E2-3S	1004	61° 12' 07.2"	150° 02' 42.4"	0.5	13.59	13.69	7.93	9.27	143	10.0	<0.005	<2.0
-3M				5.5	13.62	13.74	7.92	9.25	174			
-3B				10.5	13.62	13.76	7.92	9.20	167			

**Table 15. Hydrographic and Water Quality Data, 19 and 20 June 2001. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
E2-4S	1046	61° 11' 36.0"	150° 04' 21.7"	0.5	13.59	13.85	7.94	9.25	142	20.0	0.0148	13.0
-4M				3.5	13.62	13.84	7.93	9.22	155			
-4B				7.0	13.61	13.84	8.02	9.30	152			
E3-1S	1117	61° 12' 20.5"	150° 01' 16.7"	0.5	13.31	9.94	7.97	9.15	114	20.0	<0.005	<2.0
-1M				2.5	13.70	13.14	7.96	9.25	98			
-1B				4.5	13.70	13.13	8.00	9.24	84			
E3-2S	1131	61° 12' 20.5"	150° 02' 02.2"	0.5	13.66	13.11	7.94	9.35	101	15.0	<0.005	2.0
-2M				5.0	13.73	13.20	7.96	9.30	127			
-2B				9.5	13.71	13.33	7.96	9.15	161			
E3-3S	1154	61° 12' 09.1"	150° 02' 32.1"	0.5	13.64	4.20	7.95	9.19	34	15.0	<0.005	<2.0
-3M				5.0	13.73	13.23	7.96	9.14	120			
-3B				9.5	13.72	13.30	7.99	9.10	154			
E3-4S	1213	61° 12' 05.1"	150° 02' 48.8"	0.5	13.68	13.18	7.97	9.14	54	15.0	<0.005	<2.0
-4M				4.0	13.75	13.17	7.98	9.16	157			
-4B				8.0	13.74	13.23	7.98	9.36	158			
F1-1S	1321	61° 12' 20.8"	150° 01' 17.8"	0.5	13.76	12.51	7.88	9.31	45	15.0	0.0121	2.0
-1M				2.0	14.06	13.19	7.99	9.30	42			
-1B				4.0	14.06	13.45	7.98	9.36	56			
F1-2S	1345	61° 12' 24.8"	150° 00' 30.6"	0.5	13.84	5.21	7.99	9.34	67	20.0	<0.005	<2.0
-2M				2.5	13.93	12.65	7.98	9.29	70			
-2B				4.5	13.93	12.64	7.99	9.34	72			

**Table 15. Hydrographic and Water Quality Data, 19 and 20 June 2001. (continued)**

<b>Station Number</b>	<b>Time (ADT)</b>	<b>Latitude (North)</b>	<b>Longitude (West)</b>	<b>Depth (M)</b>	<b>Temp<sup>b</sup> (°C)</b>	<b>Salinity<sup>b</sup> (‰)</b>	<b>pH<sup>b</sup> (units)</b>	<b>D.O. (mg/L)</b>	<b>Turbidity (NTU)</b>	<b>Color (units)</b>	<b>TRC (mg/L)</b>	<b>Fecal Coliform<sup>a</sup></b>
F1-3S	1407	61° 12' 17.8"	149° 59' 47.9"	0.5	13.98	12.63	8.02	9.37	72	10.0	<0.005	2.0
-3M				2.0	14.01	12.62	8.01	9.36	78			
-3B				3.5	14.01	12.62	8.02	9.34	72			
F1-4S	1440	61° 12' 06.7"	149° 59' 01.5"	0.5	14.56	9.23	8.06	9.49	31	15.0	<0.005	2.0
-4M				2.0	14.38	11.26	8.02	9.22	21			
-4B				3.5	14.46	11.33	8.02	9.18	35			
F2-1S	1515	61° 12' 20.8"	150° 01' 16.0"	0.5	14.11	14.11	8.04	9.14	109	10.0	<0.005	2.0
-1M				4.0	14.09	14.10	8.02	9.18	108			
-1B				8.0	14.08	14.11	8.09	9.10	111			
F2-2S	1525	61° 12' 20.8"	150° 01' 16.0"	0.5	13.98	11.85	7.99	9.29	100	15.0	<0.005	8.0
-2M				5.5	14.22	14.28	8.03	9.31	114			
-2B				10.5	14.15	14.19	8.03	9.25	138			
F2-3S	1543	61° 12' 37.1"	149° 59' 28.5"	0.5	13.86	6.12	8.02	9.26	155	15.0	<0.005	<2.0
-3M				5.5	14.00	13.86	8.03	9.26	150			
-3B				10.5	14.00	13.88	8.03	9.20	142			
F2-4S	1608	61° 12' 25.9"	149° 59' 13.1"	0.5	14.22	13.43	8.02	9.21	93	15.0	<0.005	4.0
-4M				5.0	14.00	13.75	8.01	9.23	163			
-4B				10.0	14.00	13.79	8.02	9.18	206			
F3-1S	1657	61° 12' 20.5"	150° 01' 16.7"	0.5	13.63	6.44	7.99	9.24	113	15.0	<0.005	<2.0
-1M				5.0	13.70	14.17	8.01	9.20	140			
-1B				10.0	13.70	14.17	8.02	9.23	139			

**Table 15. Hydrographic and Water Quality Data, 19 and 20 June 2001. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
F3-2S	1705	61° 12' 35.2"	150° 00' 42.1"	0.5	13.74	5.34	7.98	9.20	117	10.0	<0.005	<2.0
-2M				8.0	13.72	14.16	8.02	9.22	170			
-2B				15.5	13.72	14.17	8.03	9.23	122			
F3-3S	1714	61° 12' 47.5"	150° 59' 53.1"	0.5	14.14	11.97	8.01	9.27	76	10.0	<0.005	<2.0
-3M				9.0	14.10	13.31	8.01	9.26	108			
-3B				18.0	13.74	14.07	8.02	9.26	148			
F3-4S	1730	61° 13' 04.3"	149° 58' 58.8"	0.5	13.94	6.14	7.97	9.38	127	10.0	<0.005	<2.0
-4M				22.5	13.74	13.92	8.00	9.37	167			
-4B				45.0	13.71	14.00	7.98	9.32	195			
C1-1S	1420	61° 14' 03.6"	149° 59' 30.0"	0.5	14.51	11.03	7.95	9.35	58	15.0	<0.005	<2.0
-1M				2.5	14.12	11.10	8.01	9.55	27			
-1B				4.5	14.10	11.11	8.02	9.27	50			
C1-2S	1445	61° 14' 11.9"	149° 58' 22.1"	0.5	14.33	11.12	8.02	9.42	201	15.0	<0.005	4.0
-2M				1.5	14.32	11.12	8.02	9.54	175			
-2B				3.0	14.29	11.10	8.02	9.45	201			
C1-3S	1510	61° 14' 44.9"	149° 57' 23.2"	0.5	14.40	11.16	8.03	9.44	173	15.0	<0.005	<2.0
-3M				1.5	14.40	11.17	8.01	9.33	212			
-3B				2.5	14.40	11.17	8.01	9.44	223			
C1-4S	1537	61° 14' 56.7"	149° 56' 19.1"	1.0	14.80	9.81	8.00	9.42	107	10.0	<0.005	2.0
-4M				5.0	14.88	10.67	8.03	9.39	136			
-4B				10.0	14.76	10.86	8.03	9.29	132			

**Table 15. Hydrographic and Water Quality Data, 19 and 20 June 2001. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
<b>JUNE 20</b>												
C2-1S	1610	61° 14' 03.8"	149° 59' 33.8"	0.5	14.77	11.71	7.99	9.24	120	10.0	<0.005	<2.0
-1M				5.5	14.55	11.65	8.00	9.37	164			
-1B				11.5	14.54	11.60	8.00	9.24	165			
C2-2S(A)	1625	61° 14' 9.9"	149° 57' 49.7"	0.5	14.21	4.05	8.06	9.38	118	15.0	<0.005	2.0
-2S(B)	1629			1.0	14.16	12.07	7.99	9.17	110	15.0	<0.005	<2.0
-2S(C)	1631			0.5	14.15	11.92	8.00	9.33	110	15.0	<0.005	<2.0
-2M				21.5	14.14	12.08	8.05	9.20	231			
-2B				42.5	14.12	11.81	8.05	9.29	391			
C2-3S	1708	61° 16' 16.1"	149° 53' 49.3"	0.5	NA	NA	NA	9.33	162	10.0	<0.005	<2.0
-3M				17.5	NA	NA	NA	9.26	223			
-3B				35.0	NA	NA	NA	9.06	267			
C2-4S	1725	61° 17' 37.0"	149° 53' 21.0"	0.5	NA	NA	NA	9.29	170	15.0	<0.005	2.0
-4M				25.0	NA	NA	NA	9.36	230			
-4B				>50.0	NA	NA	NA	9.34	293			
C3-1S(A)	1841	61° 14' 03.8"	149° 59' 33.8"	0.5	14.29	13.35	8.05	9.02	169	10.0	<0.005	2.0
-1S(B)	1841			0.5	---	---	---	9.13	147	10.0	<0.005	<2.0
-1S(C)	1841			0.5	---	---	---	9.10	189	10.0	<0.005	<2.0
-1M				5.5	14.25	13.39	8.04	9.18	145			
-1B				11.0	14.24	12.61	8.09	9.09	142			

**Table 15. Hydrographic and Water Quality Data, 19 and 20 June 2001. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
C3-2S	1857	61° 14' 06.5"	149° 57' 51.0"	0.5	14.20	11.64	8.09	9.17	92	10.0	<0.005	<2.0
-2M				24.0	14.03	13.28	8.13	9.18	220			
-2B				47.5	14.02	13.30	8.15	9.08	279			
C3-3S	1936	61° 15' 12.0"	149° 54' 15.5"	0.5	14.11	12.95	8.06	9.19	145	15.0	<0.005	4.0
-3M				28.0	14.03	13.22	8.06	9.22	145			
-3B				56.0	13.96	13.33	8.07	9.13	163			
C3-4S	1951	61° 15' 42.2"	149° 54' 01.0"	0.5	14.09	12.74	8.02	9.27	71	15.0	<0.005	2.0
-4M				26.5	14.00	13.34	8.07	9.30	134			
-4B				52.0	13.96	13.42	8.08	9.19	155			

<sup>a</sup> Fecal coliform reported as MPN/100 mL.

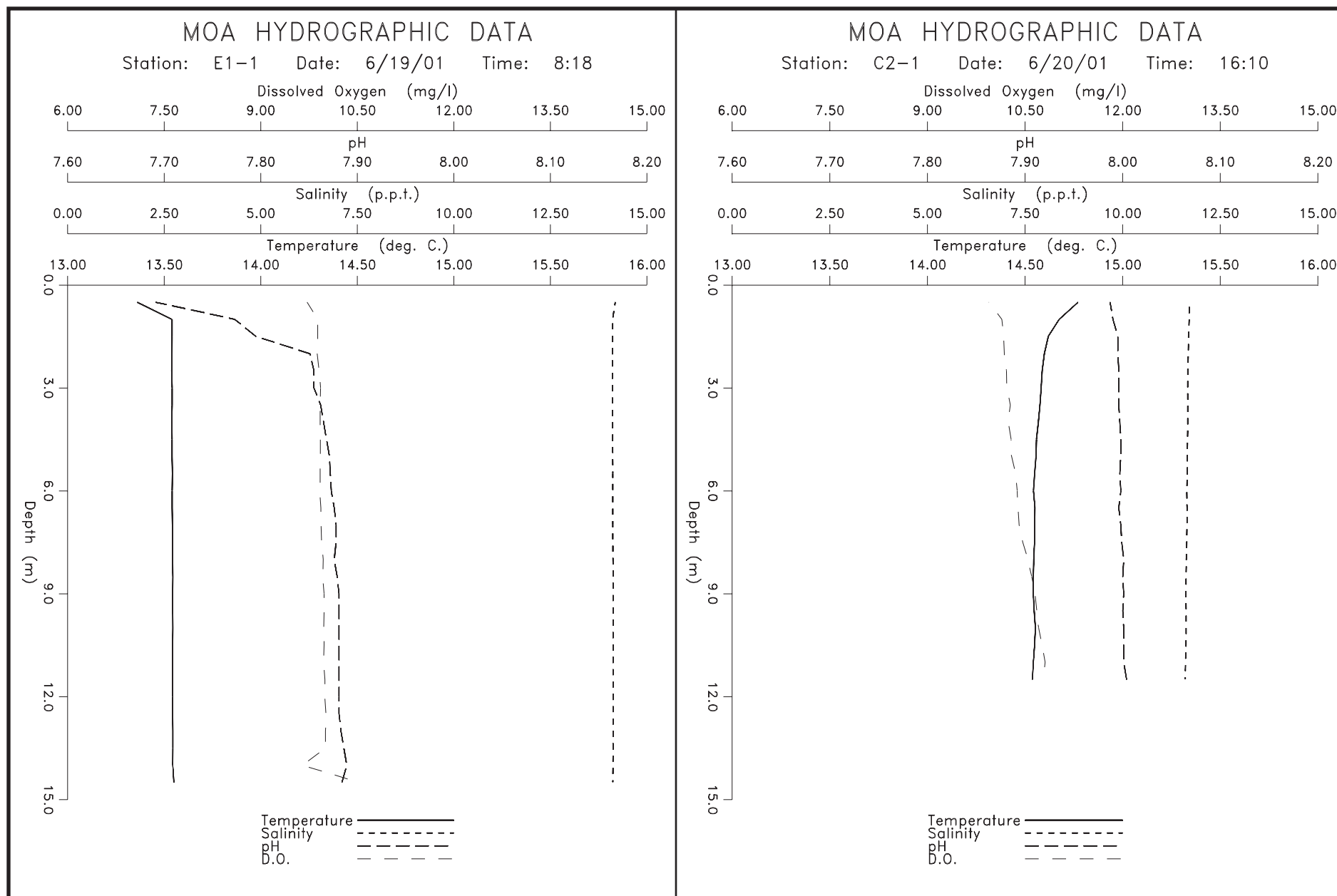
<sup>b</sup> Values from CTD for 0.5 m depth taken as close to surface as possible.

NA Not available; CTD malfunction.

--- Samples not collected.

### Outfall Station

### Control Station



**Figure 10. Sample Hydrographic Profiles from Outfall and Control Stations, June 2001.**

Fecal coliform values were quite low this year and ranged from <2.0 to 13 MPN/100 mL. The highest fecal coliform concentration was seen at a far-field station E2-4 that was located over one nautical mile from the outfall. Control stations ranged from <2.0 to 4.0 MPN/100 mL, outfall values during the ebb tide ranged from <2.0 to 13.0 MPN/100 mL, and outfall values during the flood tide ranged from <2.0 and 8.0 MPN/100 mL.

In addition to routine monitoring conducted at each water quality station, supplemental surface samples were collected from the first three stations along the first drogue trajectory for the ZID and control floods. A sample of final effluent was also obtained at the same time for comparison. Supplemental samples were analyzed for total aromatic hydrocarbons (TAH) defined as benzene, ethylbenzene, toluene, and total xylenes (BETX); polycyclic aromatic hydrocarbons (PAH); dissolved and total recoverable trace metals, cyanide, and TSS.

Metals, cyanide, and TSS results for these samples are presented in Table 16. Total metals concentrations were quite variable, and with the exception of silver (Ag), differences between the outfall and control sites did not appear to exist that could be attributed to the discharge but were the result of differences in TSS concentrations. Except for silver, control Station C1-3 was found to have the highest concentrations for each of the metals tested by total recoverable methodology. These relatively high concentrations can be attributed to high suspended sediment load at this station as evidenced by the 740 mg/L of TSS. Similarly, for the outfall stations, Stations F1-2 and F1-3 had higher concentrations for most total recoverable metals tested and TSS concentrations were twice as high as those seen at Station F1-1. Total silver was found to be highest at Station F1-1, which was located within the ZID at low slack water, and this was believed to be due to the outfall discharge which was found to contain higher concentrations of silver than the receiving water.

Dissolved metals concentrations were found to be low, but variable between stations. For all dissolved metals except lead and chromium, the highest concentrations were seen at Station F1-1 which was located at low slack water within the ZID and directly over the outfall discharge. The maximum dissolved chromium concentration was seen at Station C1-1, while the highest level of lead was seen at Station F1-3. Even though concentrations were found to be elevated in some cases at Station F1-1 when compared to the other stations, all dissolved metals concentrations met water quality criteria as they were one to two orders of magnitude (10 - 100 times) less than the State of Alaska SSWQC for the Point Woronzof area. Cyanide results from the ambient water stations were all below the detection limit of 2 µg/L. The effluent sample showed a cyanide level of 3.4 µg/L. Total suspended solid results ranged from 34 to 740 mg/L at the control stations, 90 to 190 mg/L at the outfall stations, and was 79 mg/L in the effluent sample.

Hydrocarbon analyses results are presented in Table 17. Total aromatic hydrocarbons as BETX (EPA Method 602) was determined by summing benzene, ethylbenzene, toluene, and total xylenes. For values reported as ND, the MDL was used in the summation. Total aromatic hydrocarbons at the water quality stations were below the detection limit of 0.5 µg/L at all stations, well below the receiving water standard of 10 µg/L. The effluent sample had a concentration of 6.0 µg/L, significantly less than the MAEC of 1,430 µg/L. All concentrations of individual PAHs were summed and reported as TPAH in Table 17. The highest TPAH was seen at Station F1-1 at a concentration of 0.57 µg/L; the TPAH in the effluent was 7.54 µg/L. Total aqueous hydrocarbons (TAqH) as determined by PAH plus BETX was also determined for the six stations and effluent. Concentrations of TAqH in the receiving water ranged from 2.05 to 2.57 µg/L, where the contribution from BETX was assumed to be 2 µg/L (summation of the



**Table 16. Concentrations of Dissolved Metals, Total Recoverable Metals, Cyanide, and Total Suspended Solids in Receiving Water and Effluent Samples.** Values have not been blank corrected.

Station	Arsenic	Cadmium	Cyanide	Chromium	Copper	Mercury	Nickel	Lead	Silver	Zinc	TSS
	µg/L					ng/L	µg/L				
Dissolved Metals											
F1-1S (WITHIN ZID)	1.52	0.0967	NA	0.192	3.38	0.919	1.18	0.0580	0.115	3.56	NA
F1-2S (ZID BOUNDARY)	1.49	0.0907	NA	0.174	1.52	0.786	1.14	0.0284	0.0370	1.54	NA
F1-3S (NEAR FIELD)	1.51	0.0726	NA	0.161	1.40	0.744	1.00	0.0647	0.0297	0.521	NA
C1-1S (CONTROL)	1.49	0.0700	NA	0.199	1.29	0.628	1.03	0.0197	0.0233	0.616	NA
C1-2S (CONTROL)	1.45	0.0572	NA	0.176	1.28	0.584	0.976	0.0131	0.0223	0.405	NA
C1-3S (CONTROL)	1.46	0.0596	NA	0.171	1.25	0.828	0.976	0.012U	0.0204	0.580	NA
EFFLUENT	1.61	0.234	NA	2.03	26.6	5.86	2.95	0.441	0.573	33.7	NA
DETECTION LIMIT	0.052	0.015	NA	0.120	0.029	0.07	0.036	0.021	0.013	0.052	NA
Total Metals											
F1-1S (WITHIN ZID)	3.56	0.111	ND	5.06	9.82	13.1	5.42	2.44	0.437	17.0	90
F1-2S (ZID BOUNDARY)	6.94	0.141	ND	11.9	16.5	21.1	11.8	4.83	0.111	30.8	170
F1-3S (NEAR FIELD)	5.75	0.103	ND	9.94	13.1	16.9	9.82	2.79	0.0860	23.7	190
C1-1S (CONTROL)	2.48	0.0788	ND	2.47	4.16	4.40	3.03	0.873	0.0381	6.18	34
C1-2S (CONTROL)	9.79	0.128	ND/ND	18.9	25.8	35.9	18.7	5.81	0.0100	45.4	720/680
C1-3S (CONTROL)	19.4	0.182	ND	33.0	43.1	71.5	33.8	10.2	0.170	79.9	740
EFFLUENT	1.85	0.414	3.4	4.42	50.1	84.3	4.13	3.86	7.41	75.0	79
DETECTION LIMIT	0.052	0.019	2.0	0.120	0.027	0.07	0.036	0.024	0.013	0.065	1.0

Field Sample/Field Duplicate

NA Not applicable

ND None detected

U Not detected at or above detection limit

**Table 17. Supplemental Receiving Water and Effluent Hydrocarbon Analyses.**

Parameter	Control Flood Samples			ZID Flood Samples			Effluent
	C1-1S	C1-2S	C1-3S	F1-1S	F1-2S <sup>a</sup>	F1-3S	
Volatile Organics (EPA 602) in $\mu\text{g/L}$ ; detection limit for each analyte 0.5 $\mu\text{g/L}$							
Benzene	ND	ND	ND	ND	ND/ND	ND	ND
Toluene	ND	ND	ND	ND	ND/ND	ND	4.0
Chlorobenzene	ND	ND	ND	ND	ND/ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND/ND	ND	ND
Xylenes	ND	ND	ND	ND	ND/ND	ND	ND
1,2 Dichlorobenzene	ND	ND	ND	ND	ND/ND	ND	5.1
1,3 Dichlorobenzene	ND	ND	ND	ND	ND/ND	ND	5.6
1,4 Dichlorobenzene	ND	ND	ND	ND	ND/ND	ND	ND
Total Aromatics (as BETX)	ND	ND	ND	ND	ND/ND	ND	6.0
Polynuclear Aromatic Hydrocarbons (PAH) by GC/MS in $\mu\text{g/L}$							
TPAH	0.06	0.13	0.15	0.57	0.11	0.10	7.54
Total Aqueous Hydrocarbons (TAqH) in $\mu\text{g/L}$							
TAqH <sup>b</sup>	2.05	2.13	2.15	2.57	2.11	2.10	13.04

<sup>a</sup> Duplicate field sample analysis provided (value/duplicate value)

<sup>b</sup> Defined by the State of Alaska as BETX analyte values from EPA Method 602 plus PAH analyte values from EPA Method 610 analysis, these values include the full suite of PAH analyte values not just the analyte values from EPA method 610

ND None detected

individual detection limits for each compound), compared to the receiving water quality criteria of 15 µg/L. The concentration of TAqH in the effluent was 13.04 µg/L, compared to the MAEC of 2,145 µg/L.

### **3.2.2 Intertidal Zone and Stream Bacterial Sampling**

Intertidal zone and stream bacteriological sampling was performed on 19 June 2001. Intertidal zone sampling began approximately 1½ hours prior to high tide at 18:05 ADT and was completed at 18:54 ADT. Two replicates were taken at all intertidal stations. Stream sampling was conducted from 14:00 to 14:35 ADT. In addition, an effluent sample was collected at the plant at 13:07 ADT. A summary of the sampling results is presented in Table 18. Refer to Figure 3 for a map of the station locations.

Fecal coliform concentrations ranged from <2.0 to 50.0 MPN/100 mL at the intertidal stations. Concentrations near the outfall, Stations IT-4 and IT-5, ranged from 17.0 and 50.0 MPN/100 mL for the four samples, somewhat higher than all of the other intertidal stations. The control station IT-C4, located across the inlet near Point MacKenzie, had concentrations of <2.0 and 2.0 for the two replicates. Fecal coliform concentrations found in the streams were lower than those seen in past years and ranged from 2.0 MPN/100 mL at Chester Creek to 220 MPN/100 mL at Fish Creek. The plant effluent sample taken on the same day was analyzed in duplicate and showed a value of 2.0 MPN/100 mL for both replicates.

**Table 18. Summary of Bacterial Analyses, 19 June 2001.**

<b>Station and Replicate</b>	<b>Sample Time (ADT)</b>	<b>Fecal Coliform MPN/100 mL</b>
IT-1 Replicate 1	18:54	<2.0
IT-1 Replicate 2	18:54	<2.0
IT-2 Replicate 1	18:50	2.0
IT-2 Replicate 2	18:50	2.0
IT-3 Replicate 1	18:48	<2.0
IT-3 Replicate 2	18:48	11.0
IT-4 Replicate 1	18:44	50.0
IT-4 Replicate 2	18:44	17.0
IT-5 Replicate 1	18:41	22.0
IT-5 Replicate 2	18:41	50.0
IT-6 Replicate 1	18:37	4.0
IT-6 Replicate 2	18:37	4.0
IT-7 Replicate 1	18:33	<2.0
IT-7 Replicate 2	18:33	<2.0
IT-C Replicate 1	18:05	<2.0
IT-C Replicate 2	18:05	2.0
Plant Effluent Rep. 1	13:07	2.0
Plant Effluent Rep. 2	13:07	2.0
Fish Creek Rep. 1	14:00	220.0
Fish Creek Rep. 2	14:00	130.0
Chester Creek Rep.1	14:15	2.0
Chester Creek Rep.2	14:15	2.0
Ship Creek Rep. 1	14:35	50.0
Ship Creek Rep. 2	14:35	70.0



## **4.0 QUALITY ASSURANCE/QUALITY CONTROL**

### **4.1 OBJECTIVES**

The program includes a comprehensive quality assurance/quality control (QA/QC) program that encompasses all aspects of the project, from initial sample collection and field observation recording through laboratory analysis and data analysis to reporting. The objectives of the QA/QC program were to fully document the field and laboratory data collected, to maintain and document data quality, and to ensure that the data collected are of sufficient quality to be comparable with data collected through other EPA-regulated NPDES programs. The program was designed to allow the data to be assessed by the following parameters:

- Precision
- Accuracy
- Comparability
- Representativeness
- Completeness.

These parameters were controlled by adhering to documented methods and procedures, by the analysis of quality control (QC) samples on a routine basis, through the use of laboratories with existing QA/QC plans, through data review and verification procedures, and through a comprehensive sample documentation program. Throughout the program, KLI coordinated with the subcontracting laboratories to ensure that their in-house QA/QC programs were being implemented to meet the required standards.

Quality control activities in the field included adherence to documented procedures, including those in this study plan, and the comprehensive documentation of sample collection and sample identification information. Sample integrity and identification were ensured by a rigidly-enforced chain of custody program. The chain of custody procedure documents the handling of each sample from the time the sample was collected to the arrival of the sample at the laboratory.

Analytical methods in use on the program have been approved and documented by EPA. These methods were used as project-specific protocols to document and guide analytical procedures. Adherence to these documented procedures ensure that analytical results are properly obtained and reported.

### **4.2 FIELD QUALITY CONTROL**

Quality control activities in the field consisted of the following:

- adherence to documented procedures in the workplan
- cross-checking of field identifications, measurements, and recording to ensure consistency and accuracy
- comprehensive documentation of field observations, sample collection, and sample identification information.

Sampling procedures proposed for this project have been successfully used for a number of years on the Asplund WPCF monitoring program. The use of documented and well-known procedures provides for greater likelihood of obtaining environmental samples uncontaminated by sampling procedures or apparatus. The use of project-specific field forms and data entry sheets also provide guidance for sampling procedures. Adherence to these procedures and use of these project documents helped ensure that data collected over the course of the project were comparable and accurate and that the study results are representative of conditions existing at the sampling sites.

#### **4.2.1 Documentation**

For observations made in the field, cross-checking between personnel were used as the primary method of quality control. These included, for example, review of navigational information recorded on the drogue field log. As described in the Methods section, sample documentation began in the field using pre-printed logs, labels, COC forms, and pre-determined sample identification numbers that were designed specifically for use on this project. This extensive field documentation provided a paper trail that exists for each sample or field observation and ensures credibility of the data. All field records were reviewed by the field crew leader as soon as possible after sampling was completed. Completed field logs were filed at the KLI Anchorage office upon return of the survey.

Sample integrity and identification were ensured by the COC program. The chain of custody procedure documented the handling of a sample from the time the sample was collected to the arrival of the sample at the laboratory. At the time of shipment, the field personnel kept a copy of the completed chain of custody form, and the original will accompany the samples to the laboratory.

#### **4.2.2 Sample Handling**

Samples were frozen, chilled, and/or preserved as required by the appropriate methods in the field and until receipt at the laboratory. Samples were packed in coolers along with the completed COC forms for shipment to analytical facilities as described in the Section 2.0. Coolers were securely packed with ice packs as required and sealed with signed and dated fiber tape for shipment.

#### **4.2.3 Navigation**

As described above, navigation was accomplished with a DGPS system based on the Coast Guard transmitting station in Kenai. The accuracy of the DGPS coordinates were verified by positioning the vessel over the diffuser during a low slack tide when the boil was evident and comparing DGPS readings with the known outfall location. Intertidal stations were re-occupied using a hand-held GPS, distance and bearings, and visual sitings to temporary benchmarks and landmarks. All station information was entered on the appropriate field logs and reviewed by the field leader.

#### **4.2.4 Field Instrumentation**

Field equipment used for collection, measurement, and testing were subject to a strict program of control, calibration, adjustment, and maintenance. Care was taken to ensure that the instruments used for field measurements of temperature, salinity, DO, and pH were calibrated and adjusted with appropriate standards prior to and after each sampling. The standards of calibration are in accordance with applicable criteria such as the U.S. Bureau of Standards, American Society of Testing and Materials (ASTM) Standards, and follow the instrumentation manufacturer's recommended procedures.

Temperature calibration was ensured by pre-calibration at the factory and field checks of the electronic temperature sensor against a research grade thermometer reading taken from the same sample at the same time. The electronic sensor for salinity (conductivity) was also pre-calibrated at the factory and field checked against six ambient water samples which were collected for the analysis of salinity (SM 2520B) to verify the proper operation of the probe. For pH, the electronic sensor probe was pre-calibrated using three known buffer solutions. Dissolved oxygen samples were collected from the Niskin® bottles at surface, mid-, and bottom depths at every station to compare with the DO probe readings. Levels of DO in these samples were determined using the Winkler titration method (SM 4500-O C).

#### **4.2.5 Sampling Variability**

Sampling variability was documented by sampling three replicates at one station for the water quality parameters. This included three replicate Niskin® bottle casts to obtain replicate turbidity samples and three replicate grabs at the surface for fecal coliform, color, and TRC analyses. In addition, triplicate casts of the CTD for pH, DO, temperature, and salinity were performed at one station in order to check reading variability from the probe's electronic sensors.

#### **4.2.6 Field Check Samples**

Field check samples include trip blanks for volatile organic analyses for EPA Methods 602 and 624, field blanks, field generated duplicates, and SRMs, spikes or other samples of known concentration that may be sent to the laboratory. With the exception of the trip blanks which are initiated at the laboratory, these samples were sent to the laboratory as blind samples to ensure unbiased reporting of results.

### **4.3 LABORATORY QUALITY CONTROL**

Analytical quality control for this project included the following:

- adherence to documented procedures, particularly EPA methods, internal laboratory protocols, and respective laboratory QA/QC programs
- calibration of analytical instruments
- ability of each analytical laboratory to meet analytical precision, accuracy, limits of detection, and limits of quantification that meet EPA requirements
- use of quality control samples, internal standards, and surrogate solutions

The analytical laboratories used on this project operate under the quality assurance (QA) programs described in their QA management plans. These programs involve the participation of



qualified and trained personnel; the use of standard operating procedures for analytical methodology and procedures; a rigorous system of documenting and validating measurements; maintenance and calibration of instruments; and the analysis of quality control samples for precision and accuracy tracking. The pertinent methods descriptions the laboratories are following are comprehensive and provide information concerning proper sample collection, processing, storage, and preservation; required apparatus and materials; analytical procedure; standardization and calibration techniques; quality control samples required; methods of calculating values and assessing data quality; and reporting and performance criteria.

#### **4.3.1 Documentation**

Documentation in the laboratory included finalizing the original COC forms and generating the internal documents that track samples through the laboratory (e.g., sample control logs, refrigerator logs, etc). Any deviations from the prescribed methods or internal laboratory standard operating procedures (SOPs) were documented in the project files. Data affected by such deviations were appropriately qualified, as was any data that did not meet acceptable quality criteria. Typical data qualifiers included those denoting estimated concentrations (J) or not detected (ND or U).

#### **4.3.2 Calibration**

Calibration is an integral part of any instrumental analysis. Calibration requirements for each type of analysis to be used on this project are described in the appropriate methods. Typically, instrument calibration was performed daily or on a per batch basis.

#### **4.3.3 Quality Control Procedures**

Internal laboratory quality control checks included the use of surrogate solutions and quality control samples such as procedural (or method) blanks, matrix spike/spike duplicates, standard reference materials (SRMs) or EPA QC check samples, and duplicates as specified in the EPA approved analytical procedures. Surrogate compounds were spiked into samples as appropriate to measure individual sample matrix effects that are associated with sample preparation and analysis. This includes QC samples such as procedural blanks and matrix spike samples. Surrogate compound analyses were reported in percent recovery. Results from quality control samples allow the assessment of quality assurance parameters such as accuracy and precision of the data. Any data falling outside the acceptable criteria as defined in the methods were appropriately investigated and qualified.

Method blanks are pure, organic- or metal-free reagent water that are run through the analysis process and used to verify that analyte concentrations are accurate and do not reflect contamination. Method blanks were analyzed as called for by each method, typically one per day or one per sample batch.

Laboratory accuracy was assessed by routine spiking of environmental samples with a standard addition as called for by the appropriate method. Sample spikes and matrix spike/matrix spike duplicates were run on the organic analyses collected as part of both the influent, effluent, and sludge and receiving water monitoring components of the program. These samples are fortified with components of interest following the initial analysis to check the ability of the method to recover acceptable levels and to determine accuracy of the data. Quality control charts are

prepared by the laboratories where applicable to show the range of individual measurements encountered by following procedures such as those outlined in Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters. EPA Document 430/9-82-010.

Trace metals analyses for the monitoring were supported through the use of standard reference materials (SRMs), which are quality control reference materials with known metals values that are obtained from the National Bureau of Standards and other sources. These SRMs were analyzed by the laboratory at the same time as the program samples in order to ensure laboratory accuracy. Results of the analyses of SRMs should fall within acceptable limits and can be expressed as percent recovery.

Analytical and instrument variability was checked by laboratory splitting of one larger-volume field sample per survey into triplicates and analyzing the subsamples for the various water quality parameters. The individual measurements and concentration ranges were reported for each parameter of each split. In addition, duplicate analyses of samples split in the laboratory were used as a means to assess laboratory precision.

For other water quality parameters, the following summary of QA/QC procedures will apply:

- Fecal Coliform Bacteria: *Escherichia coli* was used as a positive control for each analytical run. *Pseudomonas aeruginosa* was used as a negative control, and buffered dilution water was used as a blank. In addition, ten percent of the samples were run in duplicate.
- Enterococci Bacteria: *Streptococcus faecalis* was used as a positive control for each analytical run. *Escherichia coli* was used as a negative control, and buffered dilution water was used as a blank.
- Color: Fresh color standards were made prior to the beginning of the program. Samples were allowed to settle and were pre-treated with paper filtration to remove turbidity and reported as "true color".
- Turbidity: The instruments was calibrated with a 20.0 standard provided by the manufacturer. Due to the high turbidity in Cook Inlet, all samples were diluted to 10 % prior to analysis to ensure that the measured turbidities were within the range of the instrumentation. In addition, select samples were run in duplicate.
- Total Residual Chlorine: TRC was run by amperometric titration which requires a blank and laboratory control and laboratory control spike samples every ten samples. The amperometric titrant was standardized daily.
- Salinity: A seawater salinity standard was used to check the instrumental accuracy of the salinometer every half-hour or every ten samples whichever is more frequent.
- Dissolved Oxygen Samples: The titrant used was standardized and checked on duplicate reference samples daily. The titrant strength was rechecked during the analyses.

#### **4.3.4 Method Detection Limits**

The method detection limits (MDLs) or method reporting limits (MRLs) for the various analytes were determined using the appropriate method as described in the protocols. These MDLs or MRLs have been reported with the data (see appendices) and included in summary data tables as appropriate. Concentrations below the MDL or MRL were considered to be equal to zero and were typically qualified with the "ND" code for non-detect.

#### **4.4 DATA REVIEW AND VALIDATION**

Data were verified by performing comparisons of final data against the original documentation, including this workplan, field logs and data sheets, and analytical reports. Any discrepancies were fully documented in the program files and reported in the annual report. Data were validated according to accuracy, precision, and completeness for both the field sample collection and analytical laboratory components of the program. Qualitative evaluation and statistical procedures were used to check the quality of the field and chemical data as appropriate. The primary goals of these review and validation procedures are to ensure that the data:

- are representative of conditions in the study area
- are accurate
- demonstrate the required level of precision
- are comparable with data from other NPDES programs
- are acceptable for use as a tool to evaluate permit compliance
- allow independent technical appraisal of the program's ability to meet the monitoring objectives.

Analytical data were subjected to review upon receipt from the laboratory following guidelines such as those published in U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/013, or U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA 540/R-94/012. Items reviewed during data validation included sample holding times, results for laboratory method blanks, matrix spike/spike duplicates (MS/SD), check standards or SRMs, field and laboratory duplicates, field and trip blanks, report completeness, and laboratory performance (i.e., ability to achieve method detection limits and adherence to QA/QC criteria established for this program). Items failing to meet such validation and review procedures were noted and corrected, if possible. Items that could not be corrected and fell outside of acceptable limits (e.g., a sample analyzed outside holding time) have been noted in this annual report if they occur.

#### **4.5 QUALITY ASSURANCE/QUALITY CONTROL RESULTS**

##### **4.5.1 Field Instrumentation and Sampling Quality Control Results**

For influent, effluent, and sludge monitoring, field-generated duplicate influent and/or effluent samples were collected for analysis of total aromatic hydrocarbons (EPA 602) and pesticides during the June 2001 sampling. During the September 2001 sampling, duplicate effluent samples were collected for total aromatic hydrocarbons (EPA 602) and metals (total and dissolved antimony, selenium, and thallium). Results for these duplicate analyses are provided in Tables 9 and 10 and the appendices, and were found to be within acceptance limits. Results

from duplicate field samples collected for certain parameters during the receiving water sampling such as volatile organics (EPA Method 602), cyanide, and TSS are reported in the appropriate tables (Tables 16 and 17), and were found to be within acceptance limits.

Field blanks were collected for several parameters during each sampling event by pouring HPLC-grade deionized (DI) water into the appropriate sampling containers with the correct preservative. Trip blanks consisted of DI blank samples prepared at the laboratory that went through the same shipping and handling procedures as all the other sample containers of each analytical type; these remained unopened in the field. Field blanks and trip blanks analyzed using EPA Method 602 showed no measurable levels of the target compounds during the June 2001, September 2001, or receiving water monitoring (Appendices A2, B2, and D1). Field blanks analyzed in conjunction with the EPA 624 analyses for June 2001 and September 2001 showed no detectable levels of the target compounds (Appendices A3 and B3). However, the trip blank for EPA 624 during the June 2001 sampling showed a detectable concentration of chloroform (1.48 µg/L). The source of this contaminant is unknown, but it is unlikely this contamination occurred at the plant, since the field blank failed to show this compound above the detection limit. This compound was also detected in influent and effluent composite samples during the June 2001 sampling. The trip blank analyzed in conjunction with the EPA 624 analyses for September 2001 showed no detectable levels of the target compounds.

During the receiving water sampling, conductivity, temperature, and depth (CTD) profiles were obtained with a Seabird SEACAT SBE-19 recording oceanographic profiling system. This instrument also provided pH and DO measurements. Salinity and density were calculated from conductivity, temperature, and depth data. The CTD was equipped with a submersible pump to facilitate adequate flow across the sensors. Water samples and CTD profiles were taken simultaneously, with the former being analyzed in the laboratory except TRC, which was analyzed immediately onboard the sampling vessel. Sampling variability for water quality parameters (DO, fecal coliform bacteria, color, and turbidity) was determined by analyzing three surface samples taken at Station C2-2S (Table 19). Where appropriate, the mean, standard deviation, and coefficient of variation are included in Table 19 to provide a measure of variability for the listed parameters. The coefficient of variation for the various sample types was found to be approximately 1.2 % for DO, 0 % for color, and 4 % for turbidity. These statistics were not determined for fecal coliform due to nature of the analysis which yields only a most probable number of bacteria per 100 mL. Instead, the  $\pm 95$  % confidence limits for each sample are provided. Sampling variability for fecal coliform was found to be within the 95 % confidence limits for all three samples.

**Table 19. Sampling and Laboratory Variability for Water Quality Samples, 19 and 20 June 2001.**

Station	Subsample Designation	DO (mg/L)	Fecal Coliform* (MPN/100 mL)	Color (units)	Turbidity (NTU)	TRC (mg/L)
<b>SAMPLING VARIABILITY</b>						
C2-2S	A	9.38	2.0[1-11]	15.0	118	<0.005
	B	9.17	<2.0[—]	15.0	110	<0.005
	C	9.33	<2.0[—]	15.0	110	<0.005
Mean	---	9.29	---	15.0	113	<0.005
Standard Deviation	---	0.11	---	0	4.62	0
Coefficient of Variation	---	1.18	---	0	4.10	0
<b>LABORATORY VARIABILITY</b>						
C3-1S	A	9.02	2.0[1-11]	10.0	169	<0.005
	B	9.13	<2.0[—]	10.0	147	<0.005
	C	9.10	<2.0[—]	10.0	189	<0.005
Mean	---	9.08	---	10.0	168	<0.005
Standard Deviation	---	0.06	---	0	21.01	0
Coefficient of Variation	---	0.63	---	0	12.48	0
C1-2S	A	NA	NA	NA	201	NA
	B	NA	NA	NA	210	NA
Relative % Difference	---	---	---	---	4	---
F2-3M	A	NA	NA	NA	150	NA
	B	NA	NA	NA	147	NA
Relative % Difference	---	---	---	---	2	---
F2-4M	A	NA	NA	NA	163	NA
	B	NA	NA	NA	163	NA
Relative % Difference	---	---	---	---	0	---
F3-4B	A	NA	NA	NA	195	NA
	B	NA	NA	NA	194	NA
Relative % Difference	---	---	---	---	1	---

\* 95% confidence intervals indicated in brackets (American Public Health Association, 1992. Standard Methods for the Examination of Water and Wastewater. 18th Edition. Washington, D.C. Table 9221.IV.)

NA Not analyzed

--- Not applicable

Variability and calibration checks of the electronics probe were done by performing repeated profiles of temperature, pH, and salinity at one station (C2-2). Results of these calibration checks for the Seabird probe show that probe variability for temperature, pH, and salinity was extremely low and in most cases with a coefficient of variation of <1 % (Table 20). In addition, salinity data obtained from the CTD were compared with six salinity grab samples that were collected during the receiving water monitoring survey. Hydrographic data from the CTD can be compared with grab sample results (Appendices D4 and D5). In addition, a precision thermometer was used to verify CTD temperature readings, in-situ DO readings from the CTD were compared with Winkler titration results, and the pH sensor was calibrated against three standards prior to field deployment. The temperature and pH probes were accurate and within calibration during the survey. DO concentrations obtained from the CTD were found to be more variable and were felt to be less reliable than the values obtained by titration. Therefore, the Winkler titration results were utilized in this report.

#### **4.5.2 Laboratory Quality Control Results**

Full analytical data are provided for each laboratory in the appendices. Laboratory duplicate analyses where performed were found to have a high degree of precision and within the acceptance criteria for relative percent difference (RPD). Laboratory duplicates were performed for a number of organic analysis and were found to be within acceptance limits.

In addition to the standard laboratory QC procedures, color, fecal coliform, turbidity, and TRC samples collected at Station C3-1 during the receiving water sampling were split in the laboratory and analyzed in triplicate. Mean, standard deviation, and coefficient of variation are reported in Table 19 for these samples (where appropriate). These statistics were not determined for fecal coliform due to nature of the analysis which yields only a most probable number of bacteria per 100 mL. Instead, the  $\pm 95$  % confidence limits for each sample are provided in Table 19. Coefficient of variation was shown to be approximately 0.6 for DO and 12.5 for turbidity. Fecal coliform values were within the confidence limits. For other analyses where samples were run in duplicate, such as TRC, turbidity, and color samples, the relative percent difference between duplicates was calculated. Laboratory duplicate analyses were found to be in general very low and within acceptable limits. Duplicate results for turbidity ranged from 0 to 4 % RPD. Color duplicate results showed 0 % difference between duplicates.

Laboratory accuracy was assessed through the use of surrogate recoveries, sample and control spikes and duplicates, and SRMs. Detailed QA/QC results for all contract laboratory analyses are provided in the appendices corresponding to each analyses. Surrogates are compounds that were added to each sample and QC sample that were analyzed by GC methodology, such as volatile organic compounds (EPA 602 and 624/8260), semi-volatile organic compounds (EPA 625/8270), and pesticides (EPA 608/8081 and 614/8141A). Surrogate recoveries for all analyses were found to be within the QC recovery limits specified by the method.

Matrix spike (MS), matrix spike duplicates (MSD), laboratory control spike (LCS) and duplicate control spike (DSC) are samples and blanks that are spiked with target compounds of interest to determine percent recovery and relative percent difference between duplicates. The QC criteria include an acceptable recovery range and an RPD that should not be exceeded. Total metals, dissolved metals, cyanide, volatile organic compounds, and semi-volatile organic met QC

**Table 20. Seabird SEACAT SBE-19 CTD Probe Variability Check, 20 June 2001.**

Depth (M)	Temperature (C)			Salinity (ppt)			pH (units)			Mean (units)			Standard Deviation (units)			Coefficient Of Variation (%)		
C2-	2A	2B	2C	2A	2B	2C	2A	2B	2C	Temp	Sal	pH	Temp	Sal	pH	Temp	Sal	pH
1.0	14.29	14.16	14.17	10.27	12.07	12.00	8.06	7.99	8.00	14.21	11.45	8.01	0.071	1.018	0.038	0.50	8.89	0.48
2.0	14.31	14.16	14.14	12.05	12.07	11.97	8.06	8.00	8.00	14.21	12.03	8.02	0.094	0.055	0.037	0.66	0.46	0.46
3.0	14.26	14.16	14.15	12.07	12.07	11.98	8.06	7.99	8.00	14.19	12.04	8.02	0.064	0.053	0.037	0.45	0.44	0.46
4.0	14.26	14.16	14.15	12.07	12.07	11.99	8.06	7.99	8.00	14.19	12.04	8.02	0.062	0.050	0.037	0.44	0.41	0.46
5.0	14.23	14.16	14.14	12.09	12.04	11.96	8.06	8.00	7.99	14.17	12.03	8.02	0.048	0.069	0.036	0.34	0.58	0.45
6.0	14.23	14.14	14.14	12.09	11.94	11.95	8.06	8.01	8.00	14.17	11.99	8.02	0.053	0.083	0.031	0.38	0.69	0.39
7.0	14.26	14.13	14.15	12.08	11.89	11.98	8.06	8.01	8.00	14.18	11.98	8.02	0.070	0.095	0.030	0.49	0.79	0.38
8.0	14.26	14.13	14.14	12.08	11.89	11.99	8.06	8.01	8.00	14.18	11.99	8.02	0.070	0.092	0.030	0.50	0.77	0.38
9.0	14.25	14.13	14.14	12.08	11.86	12.04	8.06	8.01	8.00	14.18	12.00	8.02	0.065	0.116	0.032	0.46	0.97	0.39
10.0	14.23	14.17	14.15	12.09	12.09	12.01	8.06	8.01	8.00	14.18	12.06	8.02	0.045	0.047	0.032	0.32	0.39	0.39
11.0	14.21	14.17	14.15	12.10	12.08	12.02	8.06	8.01	8.00	14.18	12.07	8.02	0.031	0.042	0.032	0.22	0.35	0.39
12.0	14.21	14.16	14.18	12.10	12.10	12.02	8.06	8.01	8.00	14.18	12.07	8.02	0.021	0.048	0.030	0.15	0.40	0.38
13.0	14.22	14.14	14.17	12.09	11.96	12.02	8.06	8.01	8.00	14.18	12.03	8.02	0.043	0.063	0.032	0.30	0.52	0.39
14.0	14.16	14.13	14.15	12.12	11.92	12.08	8.05	8.01	8.01	14.15	12.04	8.02	0.014	0.103	0.026	0.10	0.86	0.32
15.0	14.15	14.14	14.15	12.12	11.92	12.01	8.06	8.01	8.01	14.15	12.02	8.03	0.008	0.103	0.030	0.05	0.86	0.37
16.0	14.16	14.14	14.15	12.13	11.92	12.02	8.05	8.01	8.00	14.15	12.02	8.02	0.010	0.105	0.028	0.07	0.87	0.34
17.0	14.16	14.14	14.15	12.12	11.92	12.02	8.05	8.01	8.00	14.15	12.02	8.02	0.010	0.097	0.028	0.07	0.81	0.35
18.0	14.17	14.14	14.15	12.11	11.93	12.00	8.05	8.01	8.01	14.15	12.01	8.02	0.015	0.094	0.027	0.11	0.78	0.33
19.0	14.15	14.14	14.15	12.09	11.92	12.00	8.05	8.01	8.01	14.15	12.00	8.02	0.008	0.083	0.026	0.06	0.69	0.32
20.0	14.15	14.13	14.15	12.09	11.90	11.99	8.05	8.01	8.01	14.14	12.00	8.02	0.009	0.093	0.024	0.07	0.78	0.30
21.0	14.15	14.13	14.15	12.09	11.89	12.00	8.05	8.01	8.00	14.14	11.99	8.02	0.011	0.104	0.025	0.08	0.87	0.32

**Table 20. Seabird SEACAT SBE-19 CTD Probe Variability Check, 20 June 2001. (continued)**

Depth (M)	Temperature (C)			Salinity (ppt)			pH			Mean (units)			Standard Deviation (units)			Coefficient Of Variation (%)		
C2-	2A	2B	2C	2A	2B	2C	2A	2B	2C	Temp	Sal	pH	Temp	Sal	pH	Temp	Sal	pH
22.0	14.15	14.13	14.15	12.07	11.88	11.99	8.06	8.01	8.01	14.14	11.98	8.02	0.008	0.093	0.026	0.06	0.77	0.33
23.0	14.15	14.13	14.15	12.05	11.89	11.98	8.05	8.01	8.00	14.14	11.98	8.02	0.007	0.080	0.027	0.05	0.66	0.33
24.0	14.15	14.14	14.15	12.05	11.91	11.98	8.05	8.01	8.00	14.14	11.98	8.02	0.005	0.066	0.027	0.03	0.55	0.33
25.0	14.14	14.13	14.14	12.05	11.89	11.96	8.05	8.01	8.00	14.14	11.96	8.02	0.007	0.078	0.025	0.05	0.66	0.31
26.0	14.15	14.13	14.14	12.07	11.85	11.92	8.05	8.01	8.01	14.14	11.95	8.02	0.009	0.115	0.024	0.06	0.96	0.30
27.0	14.15	14.13	14.14	12.08	11.83	11.94	8.05	8.01	8.01	14.14	11.95	8.02	0.010	0.125	0.024	0.07	1.04	0.30
28.0	14.15	14.13	14.17	12.08	11.84	11.94	8.05	8.01	8.00	14.15	11.95	8.02	0.023	0.121	0.023	0.17	1.01	0.29
29.0	14.15	14.13	14.14	12.07	11.83	11.94	8.05	8.01	8.01	14.14	11.95	8.02	0.010	0.121	0.023	0.07	1.01	0.29
30.0	14.14	14.13	14.14	12.07	11.87	11.95	8.05	8.01	8.01	14.14	11.96	8.02	0.009	0.103	0.025	0.06	0.86	0.31
31.0	14.15	14.12	14.14	12.07	11.79	11.96	8.04	8.01	8.00	14.14	11.94	8.02	0.014	0.142	0.022	0.10	1.19	0.27
32.0	14.15	14.11	14.14	12.07	11.74	11.93	8.05	8.01	8.00	14.13	11.92	8.02	0.016	0.167	0.022	0.12	1.40	0.28
33.0	14.15	14.11	14.13	12.07	11.74	11.84	8.05	8.01	8.01	14.13	11.89	8.02	0.015	0.168	0.021	0.11	1.41	0.26
34.0	14.14	14.09	14.13	12.05	11.74	11.80	8.05	8.01	8.01	14.12	11.86	8.02	0.025	0.160	0.022	0.18	1.35	0.27
35.0	14.14	14.12	14.13	11.98	11.76	11.81	8.05	8.01	8.01	14.13	11.85	8.02	0.011	0.120	0.021	0.08	1.02	0.27
36.0	14.14	14.12	14.13	11.94	11.87	11.81	8.05	8.01	8.01	14.13	11.87	8.02	0.010	0.062	0.024	0.07	0.52	0.30
37.0	14.13	14.12	14.13	11.91	12.01	11.82	8.05	8.01	8.01	14.13	11.91	8.02	0.008	0.094	0.023	0.06	0.79	0.28
38.0	14.13	14.13	14.13	11.87	11.81	11.83	8.05	8.01	8.01	14.13	11.84	8.02	0.002	0.034	0.024	0.02	0.29	0.30
39.0	14.13	14.15	14.13	11.85	12.00	11.83	8.05	8.00	8.01	14.14	11.89	8.02	0.013	0.096	0.026	0.09	0.81	0.32
40.0	14.13	14.15	14.13	11.83	12.03	11.83	8.05	8.00	8.01	14.14	11.90	8.02	0.015	0.116	0.026	0.10	0.97	0.32
41.0	14.12	14.15	14.13	11.82	12.02	11.82	8.05	8.00	8.01	14.13	11.89	8.02	0.014	0.116	0.027	0.10	0.97	0.33
42.0	14.12	14.14	14.13	11.82	11.93	11.81	8.05	8.00	8.01	14.13	11.85	8.02	0.008	0.067	0.026	0.06	0.56	0.32



criteria with few exceptions for MS, MSD, LCS, and DSC for all analyses on the program. Volatile (624/8260) and semi-volatile (625/8270) organic analyses conducted for the summer dry and summer wet samplings noted both low and high recoveries for a number of analytes in the LCS and DSC samples, however all compounds were found to be within acceptance limits. Surrogate recoveries were good and within acceptance limits with few exceptions. Detailed case narratives were provided by the laboratory which fully detail all QC issues for both sampling efforts and explain any QC deviations; these are provided in Appendix A3 and B3. A number of QC exceptions were also noted for the September 2001 volatile aromatic hydrocarbon (EPA 602) analysis. The LCS for toluene and chlorobenzene had low recoveries of 61 and 58 %, respectively, compared to the acceptance limits of 76 - 125 and 75 - 130 %, respectively. Also, for the September 2001 hydrocarbon analysis, the MS and MSD had low recoveries for a number of the spiked compounds and RPDs for benzene, toluene, and chlorobenzene that were outside of QC limits. For the September 2001 pesticide analysis, one surrogate recovery compound on one sample fell below acceptable QC limits due to matrix interference. For the June 2001 receiving water metals analysis, silver had a slightly low MS recovery percent due to a matrix interference.

Trace metals analyses for the influent, effluent, sludge, and receiving water testing were supported through the use of Standard Reference Materials (SRMs), which are quality control reference materials with known metals values that are obtained from the National Bureau of Standards, National Institute of Standards and Technology, or other certified standards. These SRMs are analyzed by the laboratories at the same time as the project samples in order to ensure laboratory accuracy. Results of the analyses of SRMs should fall within acceptable limits and can be expressed as percent recovery. Except for dissolved chromium and lead in the seawater SRM for the receiving water program, all metals SRM results were within acceptance limits. Relative percent differences for these two metals were above the acceptable limit of 20 % RPD at 29 % RPD for chromium and 60 % RPD for lead. The low levels of these metals certified in the SRMs are at levels of two orders of magnitude less than the receiving water limits of 50 µg/L for chromium and 8.1 µg/L for lead. These high recoveries were not seen in the 1643d SRM analysis performed for these metals, and data quality was not judged to be adversely affected. In addition, SRMs were also analyzed for TSS and cyanide receiving water samples and found to be within acceptance recovery limits (Appendix D1).

Method blanks (or procedural blanks) were also analyzed for most analyses on the program. Method blanks consist of pure, organic- or metal-free reagent water that is run through the analysis process and used to verify that analyte concentrations are accurate and do not reflect contamination. With the exception of ultra-trace level metals analyses that were conducted as part of the receiving water program, all method blanks results for the entire program showed no contamination during 2001. The method blank analyses for metals showed very small amounts of the various metals, most of which were present at levels below detection limits (Appendix D3). Lead in the total recoverable method blank and antimony in the dissolved method blank were found at levels higher than the instrument detection limits. This is typical for low-level analyses such as these and does not adversely affect data quality. The method blank analyses performed with the TSS and cyanide analyses showed no results above method detection limits. In addition to the typical method blanks, buffered dilution water was used as a blank for fecal coliform and enterococci bacteriological analyses. All blanks run for fecal coliform and enterococci showed no growth.

## **5.0 DISCUSSION**

### **5.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING**

The NPDES permit for the Asplund WPCF requires compliance with applicable State water quality standards as promulgated in Chapter 70 of the Alaska Administrative Code entitled "Water Quality Standards" (18 AAC 70; ADEC, 1999). This chapter requires that criteria outlined in "EPA Quality Criteria for Water" (also known as "The Red Book"; EPA, 1976), the revised quality criteria for water published in 1986, and other applicable criteria as referenced in the AWQS be met in applicable receiving waters at every point outside of the ZID boundary. Also, as noted in Section 1.1.1, the State of Alaska water quality regulations include SSWQC for the Point Woronzof area of Cook Inlet for turbidity and the dissolved fraction of arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, selenium, and silver. However, at this time EPA has not approved the SSWQC for acute nickel, acute and chronic selenium, and acute zinc since Alaska remains in the National Toxic Rule (NTR) for these pollutants. It is expected that Alaska will be removed from the NTR and the SSWQC approved by EPA for these metals in the near future. Therefore, we have used the SSWQC to evaluate the data in this report. Finally, the permit itself includes some effluent limitations that must be met. The following sections discuss the parameters of concern in regards to the requirements of the NPDES permit or the AWQS as well as historical data from the WPCF, data from other publicly-owned treatment works (POTWs), or other EPA data.

#### **5.1.1 Influent and Effluent Monitoring**

Table 21 lists permit effluent limitations and water quality criteria that are applicable to the current NPDES permit; it includes each of the parameters required to be monitored by the permit. Most of the values shown are the chronic toxicity criteria for salt water aquatic life. Chronic toxicity criteria concentrations are lower than acute toxicity criteria concentrations; therefore, the most stringent of the two were used here for comparison. The MAEC for each constituent was calculated from the outfall design dilution factor of 142:1, the water quality criteria, and the natural background concentrations. It was assumed that the final effluent would be diluted by a minimum factor of 142 by the time it reached the boundary of the ZID. For most metals, the MAECs were calculated from the SSWQC for dissolved metals contained in the AWQS for the Point Woronzof area.

To determine compliance with State water quality standards, Table 21 can be compared with effluent values found in Table 8 through Table 11 as well as those in Table 16 and Table 17. The AWWU 2001 maximum effluent concentrations shown in Table 21 were the maximum encountered during the calendar year either during AWWU's in-plant monitoring, the toxic pollutant and pesticide monitoring events, pretreatment monitoring, or the receiving water sampling event. For metals, both total and dissolved concentrations in the effluent were compared against their MAEC, since it is assumed that all of the metals contained in the effluent are potentially bioavailable upon entering the receiving water. All effluent concentrations were found to be much lower than the MAECs from the permit or computed from the water quality standards provided for in the AWQS. In addition, all the permit limitations but one (for TRC) were met for the 2001 program year. Individual parameters are discussed more fully below.

**Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2001 Maximum Concentrations for Effluent Comparisons.** Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup> (µg/L)		Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC) (µg/L)	AWWU 2001 Maximum Effluent Concentration <sup>c</sup> (µg/L)
Antimony	146	Human health, not listed for saltwater aquatic life	20,607	ND (10) <sup>d</sup>
Arsenic	36	Chronic toxicity, measured as dissolved	4,882	7 <sup>d,e</sup>
Beryllium	11	For the protection of aquatic life in soft fresh water	1,513	ND (0.03) <sup>e</sup>
Cadmium	9.3	Chronic toxicity, measured as dissolved	1,322	1.0 <sup>e</sup>
Chromium (VI) <sup>i</sup>	50	Chronic toxicity, measured as dissolved	7,038	4.42 <sup>f</sup>
Copper	3.1	Chronic toxicity, measured as dissolved	317	56 <sup>e</sup>
Lead	8.1	Chronic toxicity, measured as dissolved	1,140	19 <sup>e</sup>
Mercury	0.025	Chronic toxicity, measured as dissolved	2.72	0.2 <sup>e</sup>
Nickel	8.2	Chronic toxicity, measured as dissolved	978	6 <sup>e</sup>
Selenium <sup>k</sup>	71	Chronic toxicity, measured as dissolved	10,136	ND (10) <sup>d</sup>
Silver	1.9	Acute toxicity, measured as dissolved	257	10.7 <sup>e</sup>
Thallium	2,130	Acute toxicity to saltwater aquatic life	306,567	ND (10) <sup>d</sup>
Zinc	81	Chronic toxicity, measured as dissolved	11,249	80 <sup>e</sup>

**Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2001 Maximum Concentrations for Effluent Comparisons. (continued)** Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup>  (µg/L)		Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC) (µg/L)	AWWU 2001 Maximum Effluent Concentration <sup>c</sup> (µg/L)
Cyanide	1	For marine aquatic life	143	ND(10) <sup>e</sup>
Total Aqueous Hydrocarbons (TAqH)	15	Growth and propagation of fish, shellfish, aquatic life, and wildlife including seabirds, waterfowl, and furbearers <sup>g</sup>	2,145	13.04 <sup>f</sup>
Total Aromatic Hydrocarbons as BETX	10	Same as above <sup>g</sup>	1,430	11 <sup>d</sup>
pH		<i>h</i>	6.5 - 8.5 (pH units)	6.7 – 7.6 (pH units) <sup>e</sup>
Total Residual Chlorine (TRC)		<i>h</i>	Daily Max. 1.2 mg/L	Daily Max. >1.2 mg/L <sup>e</sup> <b>Final Effluent Maximum Daily TRC limit of 1.2 mg/L exceeded 12/6/01 with a result of &gt;1.2mg/L. EPA &amp; ADEC informed by letter 12/14/01.</b>
BOD <sub>5</sub>		<i>h</i>	Monthly Avg. 240 mg/L Weekly Avg. 250 mg/L Daily Max. 300 mg/L Removal Rate >30 %	Monthly Avg. 142 mg/L <sup>e</sup> Weekly Avg. 164 mg/L <sup>e</sup> Daily Max. 195 mg/L <sup>e</sup> Monthly Rate 38-47% <sup>e</sup>

**Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2001 Maximum Concentrations for Effluent Comparisons. (continued)** Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup>	Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC)	AWWU 2001 Maximum Effluent Concentration <sup>c</sup>
Total Suspended Solids (TSS)	<i>h</i>	Monthly Avg. 170 mg/L Weekly Avg. 180 mg/L Daily Max. 190 mg/L Removal Rate >30%	Monthly Avg. 46 mg/L <sup>e</sup> Weekly Avg. 79 mg/L <sup>e</sup> Daily Max. mg/L <sup>e</sup> Monthly Rate 73-85% <sup>e</sup>
Fecal Coliform	<i>h</i>	Monthly geometric mean of at least five samples shall not exceed 850. Not more than 10% of samples shall exceed 2600 FC MPN/100 mL. <sup>j</sup>	Monthly geometric mean did not exceed 119. Less than 10 % of the samples collected each month exceeded 2600 FC MPN/100 mL. <sup>e</sup>

*a* Alaska Administrative Code, 1999. Water Quality Standards, Chapter 70 (18 AAC 70)

*b* Effluent water quality criteria were determined by assuming a dilution of 142:1 at the ZID boundary, where: MAEC = 142 \* (Criteria - Natural Background Concentration) + Criteria; pollutant concentrations in the effluent should not exceed these values.

*c* For metals, the maximum effluent concentration was determined from both total and dissolved concentrations.

*d* Values from June 2001 or September 2001 toxic pollutant and pesticide samplings.

*e* Values from AWWU's pretreatment program.

*f* Values from effluent tested during receiving water sampling event.

*g* Alaska Administrative Code, 1999. Water Quality Standards, Chapter 70 (18 AAC 70).

*h* MAECs are not based on water quality criteria but instead are specified in MOA's 2000 NPDES permit.

*i* All samples tested as total chromium.

*j* The current permit actually shows this criterion to be not more than 10 % of sample shall exceed 2600 FC MPN/mL; this is believed to be a typographical error.

*k* SSWQC for dissolved selenium is pending approval by EPA once Alaska is removed from the NTR for that pollutant.

MGD Million gallons/day.

When the MAECs for metals and cyanide in Table 21 were compared to AWWU's self-monitoring effluent data, the toxic pollutant and pesticides sampling events (June 2001 and September 2001), the pretreatment monitoring data, and the effluent data from the receiving water quality sampling event, no constituent exceeded their MAECs. The highest concentrations of either total or dissolved metals seen in 2001 were all well below their respective MAECs. The two metals that most closely approached their MAECs at any time were copper and mercury, and both of these were still seen at levels considerably below their MAECs. The maximum concentration of total copper was 56 µg/L compared to an MAEC of 317 µg/L. The highest dissolved copper concentration that was seen was 42 µg/L. The maximum concentration of total mercury seen was 0.2 µg/L, while the highest dissolved mercury was below detection limits (<0.1 µg/L) compared to an MAEC of 2.72 µg/L.

Those metals without SSWQC, while analyzed as both total and dissolved metals as called for by the permit, are compared to total metal MAECs as provided by EPA criteria and as called for by the AWQS. Total metals concentrations for antimony, beryllium, and thallium were generally low, often below detection limits, and all well below their MAECs. As in past years, total metals detected in the influent and final effluent of the Asplund WPCF were compared with data from an EPA study of 40 Publicly Owned Treatment Works (POTWs) in Table 22 (EPA, 1982). Without exception, metals and cyanide values were lower than or within the range of those detected in other POTWs from across the nation, even though the Asplund WPCF provides only primary treatment as compared to secondary treatment provided at the other plants.

Historic influent and effluent total metals and cyanide concentrations collected as part of AWWU's self-monitoring program are presented in Table 23 and Table 24. It should be noted that under the previous permit, the reporting year was November - October, which differs from the current permit's reporting period of the calendar year. With few exceptions, concentrations are fairly consistent over time. Bis(2-ethylhexyl)phthalate was elevated in the September 2001 sampling compared to June 2001 and most historical data, but was still well within the range of those values seen at POTW facilities in both influent and effluent. Concentrations of total metals and cyanide concentrations seen in the influent and effluent during 2001 were found to fall within the range of concentrations seen during prior years. Prior to 2000 when the permit requirements changed, dissolved metals had only been analyzed in a single sample of effluent collected each year during the receiving water sampling, and historical data have not been presented in this report. Subsequent reports will include historical dissolved metal data as more become available.

During previous years, total copper levels would sometimes exceed the previous permit's MAEC of 100 µg/L. While this permit limit is no longer in effect, it is interesting to note that the maximum total copper concentration encountered in the effluent during the year 2001 in-plant monitoring was considerably lower at 56 µg/L. The reasons for the elevated copper concentrations in previous years were investigated and reported to the Municipality by CH2M Hill and the AWWU laboratory. The conclusion of the copper investigation was that most of the copper in the influent is from the leaching of copper from residential plumbing rather than industrial discharge (CH2M Hill, 1987; CH2M Hill et al., 1988). Neither enforcement of the sewer ordinance (AMC 26.50) nor the industrial pretreatment program was expected to significantly reduce the amounts of copper received at the Asplund WPCF. The mass of copper in the plant influent and effluent remained fairly constant from 1986 through 1991. From 1991 to 1992, the in-plant copper loading dropped by approximately twenty-five percent. The exact cause of this decrease is unknown, however, an increase in pH (to 8.0) at the Water Treatment

**Table 22. Comparison Between Influent/Effluent Analysis Results for Anchorage and 40 POTWs.<sup>a</sup>** Values in brackets indicate results from EPA Method 602.

Parameter	Anchorage Values				40 POTW Study Values				
	2001 Concentration <sup>b,c</sup> (µg/L)				Frequency of Detection (%)		Range Detected (µg/L)		Influent Median
	Summer-Dry		Summer-Wet		Influent	Secondary Effluent	Influent	Secondary Effluent	(µg/L)
	INF	EFL	INF	EFL					
VOLATILES									
Toluene	6.41[3.8]	9.37[4.2/4.2]	10.3[6.9]	8.95[8.0/7.7]	96	53	1-13000	1-1100	27
Ethylbenzene	0.55[ND]	ND[ND/ND]	1.50[ND]	2.40[ND/ND]	80	24	1-730	1-49	8
Total Xylenes	2.86[1.4]	2.42[ND/ND]	8.31[ND]	12.51[ND/ND]	NA	NA	NA	NA	NA
Benzene	ND[ND]	1.62[ND/ND]	3.59[ND]	1.99[ND/ND]	61	23	1-1560	1-72	2
Chloroform	3.17	2.98	2.28	3.60	91	82	1-430	1-87	7
Tetrachloroethene	2.91	2.16	3.35	2.34	95	79	1-5700	1-1200	23
Methylene chloride	ND	ND	ND	ND	92	86	1-49000	1-62000	38
1,2-Dichlorobenzene	ND[7.1]	ND[6.2/6.0]	ND[ND]	ND[ND/ND]	23	8	1-440	1-27	NA
1,3-Dichlorobenzene	ND[1.3]	ND[4.5/4.6]	ND[ND]	ND[ND/ND]	7	2	2-270	5-5	NA
1,4-Dichlorobenzene	ND[1.1]	ND[1.1/1.1]	1.51[1.7]	1.27[1.7/1.7]	17	3	2-200	3-9	NA
SEMI-VOLATILES <sup>d</sup>									
Bis(2-ethylhexyl)phthalate	34.0	22.9	123	272	92	84	2-670	1-370	27
Diethylphthalate	ND	ND	11.6	12.6	53	13	1-42	1-7	3
Phenol	42.0	ND	ND	ND	79	29	1-1400	1-89	7
TOTAL METALS & OTHER COMPONENTS									
Antimony	ND	ND	ND	ND/ND	14	13	1-192	1-69	NA
Arsenic	3	ND	4	ND	15	12	2-80	1-72	NA
Beryllium	0.06	ND	ND	ND	3	1	1-4	1-12	NA
Cadmium	0.5	0.3	0.5	0.3	56	28	1-1800	2-82	3
Chromium	5.6	4.1	4.1	3.2	95	85	8-2380	2-759	105
Copper	88	56	82	39	100	91	7-2300	3-255	132
Lead	10	6	13	6	62	21	16-2540	20-217	53
Mercury	0.4	0.2	0.4	0.1	70	31	0.2-4	0.2-1.2	0.517
Nickel	6	3	7	4	79	75	5-5970	7-679	54
Selenium	ND	ND	ND	ND/ND	9	10	1-10	1-150	NA
Silver	12.8	10.7	10.9	6.0	71	25	2-320	1-30	8
Thallium	ND	ND	ND	ND/ND	3	2	1-19	1-2	NA
Zinc	130	70	140	60	100	94	22-9250	18-3150	273
Cyanide	ND	ND	ND	ND	100	97	3-7580	2-2140	249

<sup>a</sup> Source: EPA, 1982. *Fate of Priority Pollutants in POTWs*. Final Report, Volume I, Effluent Guidelines Division, WH-552, EPA 440/1-82/303

<sup>b</sup> Data from NPDES 2001 toxic pollutant and pesticide monitoring

<sup>c</sup> Duplicate analyses provided for some analyses (value/field duplicate value)

<sup>d</sup> Only analytes detected above the detection limit in either the influent or effluent are included

E Estimated value

NA Not available

ND Not detected

**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years.** Values in brackets are from EPA Method 602.

Pollutant	1996		1997		1998	
	Wet <sup>c</sup>	Dry <sup>c</sup>	Dry <sup>c,d</sup>	Wet <sup>c</sup>	Dry <sup>c,d</sup>	Wet <sup>c</sup>
	8/6-7	8/16-17	6/30-7/1	8/19-20	6/18-19	8/11-12
<b>ORGANICS (µg/L)</b>						
* Acetone	87 <sup>e</sup>	106 <sup>e</sup>	ND	ND	ND	ND
Benzene	0.39[0.5/0.6]	0.47[1.0/0.9]	1.26[0.96/0.86]	ND[0.81/0.82]	ND[0.7/0.7]	ND[1.3/1.3]
* Benzoic Acid	181	201/157	ND	ND	ND	ND
* Benzyl Alcohol	15.0	12.3/9.8	8.97	ND	ND	ND
Bis-(2-ethylhexyl)phthalate	ND	ND	13.3	ND	9.6 J	15
Bromodichloromethane	0.20	0.24	ND	ND	ND	ND
Butyl benzyl phthalate	ND	ND	ND	ND	1.4 J	ND
Chloroform	3.7	3.0	3.39	2.98	2.92	3.3
* 1,2-Dichlorobenzene	ND/NT/[ND/ND]	ND/ND/ND/[ND/ND]	ND/ND/[ND/ND]	ND/ND/[ND/ND]	ND/ND/[1.3/1.4]	ND/ND/[1.9/0.72]
* 1,3-Dichlorobenzene	ND/ND/[ND/ND]	ND/ND/ND/[ND/ND]	ND/ND/[ND/ND]	ND/ND/[ND/ND]	ND/ND/[ND/ND]	ND/ND/[ND/ND]
* 1,4-Dichlorobenzene	2.15/ND/[ND/ND]	1.50/ND/ND/[ND/ND]	1.12/ND/[1.6/1.5]	1.29/ND/[ND/ND]	1.2/ND/[4.3/4.2]	ND/ND/[8.8/9.9]
Diethyl phthalate	4.22	3.8/3.3	5.54	ND	1.7J	ND
Di-n-butyl phthalate	ND	ND/ND	ND	ND	1.3 J	ND
Di-n-octyl phthalate	ND	ND	ND	ND	1.7 J	ND
Ethylbenzene	1.29[0.6/0.6]	0.84[1.0/1.1]	1.23[0.87/0.86]	ND[ND/ND]	0.06[0.5/0.5]	ND[1.5/1.5]
Methylene Chloride	7.84	4.13	ND	6.75	3.35	7.2
* 4-Methylphenol	56.7	58/49	44.0	ND	NT	NT
Phenol	17.7	8.9/6.9	ND	ND	ND	12
Tetrachloroethene	0.59	1.45	1.19	1.42	1.50	3.2
Toluene	13.8[11/11]	10.5[11/10]	14.4[9.3/9.1]	9.09[9.4/9.5]	8.6[6.4/6.3]	9.5[8.0/8.0]
1,1,1-Trichloroethane	ND	ND	7.92	ND	ND	ND
Trichloroethene	0.24	0.25	ND	ND	ND	ND
* Total Xylenes	8.71[2.3/2.4]	6.09[3.8/4.9]	7.66[5.4/5.3]	3.60[3.3/3.2]	NT[2.6/2.6]	NT[9.8/9.9]
Total Hydrocarbons as Oil and Grease <sup>a</sup>	ND	10000/ND	26100	25300	25000/25000	30000
Total Petroleum Hydrocarbons <sup>b</sup>	ND	ND/ND	1630	1820/2090	1820/2090	2600
Total Aromatic Hydrocarbons as BETX <sup>h</sup>	24.2[14.4/14.5]	17.9[16.8/16.9]	24.6[16.5/16.1]	14.7[14/14]	10.6[10.21/10.11]	11.5[20.6/20.7]



**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)** Values in brackets are from EPA Method 602.

Pollutant	1999		2000		2001	
	Dry <sup>c</sup>	Wet <sup>c</sup>	Dry <sup>c</sup>	Dry <sup>c</sup>	Dry <sup>c</sup>	Wet <sup>c</sup>
	6/8-9	8/24-25	6/6-7	8/14-15	6/19-20	9/4-5
<b>ORGANICS (µg/L)</b>						
* Acetone	NT	NT	NT	NT	NT	NT
Benzene	ND[0.58/0.57]	3.0[ND/ND]	ND[ND/ND]	4.3[5.3/5.3]	1.62[ND/ND/ND]	1.99[ND/ND]
* Benzoic Acid	NT	NT	NT	NT	ND	109
* Benzyl Alcohol	NT	NT	NT	NT	NT	NT
Bis-(2-ethylhexyl)phthalate	11 J	21 B/ND <sup>f</sup>	ND	10	22.9	272
Bromodichloromethane	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate	3.6 J	ND	ND	ND	ND	ND
Chloroform	2.8	5.4	3.8	3.3	2.98	3.60
* 1,2-Dichlorobenzene	ND/ND/[17/ND]	ND/ND/ND[ND/2.9]	ND/ND/[ND/11]	ND/ND/[9.5/8.0]	ND/ND/[6.2/5.6/6.0]	ND/ND/[ND/ND]
* 1,3-Dichlorobenzene	1.1/ND/[ND/ND]	ND/ND/ND[ND/ND]	1.8/ND/[10/11]	ND/ND/[ND/ND]	ND/ND/[4.5/4.4/4.6]	ND/ND/[ND/ND]
* 1,4-Dichlorobenzene	1.1/ND/[6.8/7.1]	1.6/ND/ND[4.4/3.4]	ND/ND/[15/24]	ND/ND/[7.1/6.3]	ND/ND/[1.1/1.1/1.1]	1.27/ND/[1.7/1.7]
Diethylphthalate	8.0 J	ND	ND	ND	ND	12.6
Di-n-butyl phthalate	ND	ND	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND	ND	ND
Ethylbenzene	1.6[4.2/4.2]	2.6[ND/ND]	1.0[ND/ND]	4.1[6.5/6.3]	ND[ND/ND/ND]	2.40[ND/ND]
Methylene Chloride	6.8	5.7	3.8	1.8	ND	ND
* 4-Methylphenol	NT	NT	NT	NT	NT	NT
Phenol	ND	ND/49 <sup>f</sup>	ND	ND	ND	ND
Tetrachloroethene	1.6	1.4	1.3	1.4	2.16	2.34
Toluene	12[18/17]	32[8.5/8.4]	10[7.0/6.8]	27[23/23]	9.37[4.2/4.0/4.2]	8.95[8.0/7.7]
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND
* Total Xylenes	NT[28/28]	NT[2.6/2.4]	NT[10/6.3]	NT[37/37]	2.42[ND/ND/ND]	12.51[ND/ND]
Total Hydrocarbons as Oil and Grease <sup>a</sup>	7800/7200	11000	21200	20300	21200	20400
Total Petroleum Hydrocarbons <sup>b</sup>	ND/ND	ND	ND/ND	ND	NT	NT
Total Aromatic Hydrocarbons as BETX <sup>h</sup>	14.6[50.8/49.8]	37.6[12.1/11.8]	12.0[18/14.1]	35.4[71.8/71.6]	13.6[5.7/5.5/5.7]	25.8[11.0/10.7]

**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)** Values in brackets are from EPA Method 602.

Pollutant	1996		1997		1998	
	Wet <sup>c</sup>	Dry <sup>c</sup>	Dry <sup>c</sup>	Wet <sup>c</sup>	Dry <sup>d</sup>	Wet
	8/6-7	8/16-17	6/30-7/1	8/19-20	6/18-19	8/11-12
<b>TOTAL METALS (μg/L)</b>						
Antimony	<10	<10/<10	ND	ND/ND	ND	ND
Arsenic	4	3	2	3	3	13
Beryllium	<0.1	<0.1	ND	ND	ND	ND
Cadmium	<4	4	ND	ND	ND	ND
Chromium	5	8	ND	ND	ND	ND
Copper	67	47	56	53	60	49
Lead	5	5	12	19	3	8
Mercury	<0.3	<0.3	ND	ND	0.1	ND
Molybdenum	2.6	ND/ND	ND	ND/ND	ND	ND
Nickel	20	20	ND	30	10	40
Selenium	<2, <10 <sup>g</sup>	<2, <10/<10 <sup>g</sup>	ND, ND <sup>g</sup>	ND, ND/ND <sup>g</sup>	ND	ND
Silver	8.6	8.2	8.8	8.2	5.7	11.3
Thallium	<10	<10/<10	ND	ND/ND	ND	ND
Zinc	77	74	40	73	65	79
<b>PESTICIDES (μg/L)</b>						
alpha-BHC	ND/ND	ND	ND/ND	ND	ND/ND	ND
gamma-BHC (lindane)	0.094/ND	0.12	ND/ND	ND	ND/ND	ND
4,4'-DDE	ND/ND	ND	ND/ND	ND	ND/ND	ND
Malathion	ND/ND	ND	ND/ND	ND	ND/ND	ND
Parathion	ND/ND	ND	ND/ND	ND	ND/ND	ND
<b>OTHER</b>						
Cyanide (μg/L)	30	20	20	20	ND	ND
Asbestos (million fibers/L) <sup>g</sup>	ND	ND	ND	ND	ND	ND

**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)** Values in brackets are from EPA Method 602.

Pollutant	1999		2000		2001	
	Dry	Wet	Dry <sup>c</sup>	Dry <sup>c</sup>	Dry	Wet <sup>c</sup>
	6/8-9	8/24-25	6/6-7	8/14-15	6/19-20	9/4-5
<b>TOTAL METALS (µg/L)</b>						
Antimony	ND	ND	ND	ND	ND	ND/ND
Arsenic	3	3	ND	3	ND	ND
Beryllium	ND	ND	ND	ND	ND	ND
Cadmium	ND	15	ND	ND	0.3	0.3
Chromium	ND	ND	ND	10	4.1	3.2
Copper	70	50	54	53	56	39
Lead	5	3	4.8	8	6	6
Mercury	0.2	ND	0.1	ND	0.2	0.1
Molybdenum	ND	ND	ND	NT	NT	NT
Nickel	20	ND	ND	ND	3	4
Selenium	NT	ND	ND	ND	ND	ND/ND
Silver	8.9	8.4	5.3	5.3	10.7	6.0
Thallium	ND	ND	ND	ND	ND	ND/ND
Zinc	78	95	77	80	70	60
<b>PESTICIDES (µg/L)</b>						
alpha-BHC	ND	0.067	ND/ND/ND	ND/ND	ND/ND/ND	ND
gamma-BHC (lindane)	ND	ND	ND/ND/ND	ND/ND	ND/ND/ND/	ND
4,4'-DDE	ND	ND	ND/ND/ND	0.020/ND	0.04/ND/ND/	ND
Malathion	0.13	6.7	ND/ND/ND	ND/ND	ND/ND/ND	ND
Parathion	ND	0.56	ND/ND/ND	ND/ND	ND/ND/ND	ND
<b>OTHER</b>						
Cyanide (µg/L)	ND	ND	10	10.8	ND	ND
Asbestos (million fibers/L)	ND	ND	ND	46	20	13

- \* Non-priority pollutants
- a Analyzed using method SM 503B (1997; 1998); method EPA 1664 HEM (1996; 1998; 1999; 2000; 2001)
- b Analyzed using method SM 503E (1997; 1998); method EPA 1664 SGT-HEM (1996; 1998; 1999; 2000; 2001)
- c Duplicate effluent collected (field duplicate) or analyzed (lab duplicate) shown as value/duplicate value
- d Values from EPA Method 624 are the result of averaging eight samples with zero used for ND (1998 Dry)
- e Acetone was classified as a Tentatively Identified Compound in 1996
- f First EPA 625 sample run showed contamination in method blank; second run (outside holding time) also reported (1999 Wet)
- g Selenium tested by two laboratories shown as AWWU value, ToxScan value (1996; 1997)
- h BTEX calculated from EPA 624 for years 1998-2000 do not include xylenes as they were not tested
- B Compound also detected in method blank
- J Estimated value
- ND Not detected
- NT Not tested

**Table 24. Historical Discharge Monitoring Data (1986 - Present) for Influent and Effluent Total Metals and Cyanide.** Concentrations are in  $\mu\text{g/L}$ . Values represent average (Avg) or monthly minimum (Min) and maximum (Max) for 1996-1999 (program years running Nov. - Oct.) or a range of the results for years 1986-1995 as available. Results for 2000 include Avg., Min. or Max. of seven monthly values (Jan. - July) and pretreatment monitoring values (average of three results in August 2000). Results for 2001 represent pretreatment monitoring values (average of three results in both August and Sept. 2001).

Year	Average Flow (MGD)	Arsenic		Beryllium		Cadmium		Copper		Lead		Mercury		Nickel		Silver		Zinc		Chromium		Cyanide	
		Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.
1986-1995 Min	23	<1	<1	<0.1	<0.1	<0.5	<0.5	36	38	<1	<1	<0.2	<0.2	<1	<1	3	1	54	41	<1	<1	<0.4	1
1986-1995 Max	39	26	16	0.1	<0.1	20	30	280	150	76	50	3.0	1.5	60	60	30	98	260	240	50	120	85	47
1996 Avg	30	3	2	<0.1	<0.1	5	4	91	51	12	7	0.4	<0.3	21	22	10.2	6.6	153	69	19	24	10	29
1996 Min	28	<1	<1	<0.1	<0.1	<4	<4	78	41	<1	<1	<0.3	<0.3	<20	<20	4.1	3.1	124	56	<4	10	<10	20
1996 Max	33	7	5	0.1	0.1	8	7	114	63	21	17	0.7	<0.3	30	30	17.0	12.4	201	80	112	98	10	50
1997 Avg	34	3	2	<0.1	<0.1	5	5	93	50	20	7	0.4	<0.2	24	23	9.4	6.4	140	64	7	12	<10	21
1997 Min	29	1	<1	<0.1	<0.1	<4	<4	63	10	10	4	<0.2	<0.2	<20	<20	3.4	2.2	91	38	<4	<5	<10	<10
1997 Max	40	5	4	0.3	0.2	7	5	123	64	59	11	0.8	0.2	40	40	17.5	10.0	186	97	13	23	<10	40
1998 Avg	29	4	3	0.1	0.1	5	5	74	41	12	6	0.3	0.2	26	22	11.1	6.8	136	64	8	10	15	15
1998 Min	27	<2	<2	<0.1	<0.1	<5	<5	60	30	4	<1	<0.2	<0.1	<20	<20	4.4	3.0	104	53	<5	<5	<10	<10
1998 Max	31	13	15	0.1	0.1	6	6	90	60	26	21	0.5	<0.2	77	40	16.1	11.1	182	88	10	16	<40	20
1999 Avg	29	4	3	0.2	0.2	6	6	91	57	22	7	0.5	0.2	28	22	7.1	4.9	142	77	11	12	<10	13
1999 Min	27	2	2	<0.1	<0.1	<5	<5	78	40	8	2	<0.1	<0.1	<20	<20	3.8	1.5	103	45	<10	<10	<10	<10
1999 Max	33	6	6	0.4	<0.4	17	10	120	70	149	15	1.5	0.4	50	40	12.6	7.9	197	114	20	20	<10	30
2000 Avg	29	6	3	<0.1	<0.1	<5	<5	84	46	11	8	0.3	<0.1	20	20	13.0	6.0	130	70	<10	<10	<10	<10
2000 Min	27	3	<3	<0.1	<0.1	<5	<5	60	30	6	<1	<0.1	<0.1	<20	<20	2.1	2.4	80	50	<10	<10	<10	<10
2000 Max	34	19	4	<0.1	<0.1	9	10	129	60	24	27	0.6	0.2	40	50	30.4	10.5	170	100	10	10	<10	10
2001 Avg	28	4	3	0.04	0.03	0.6	0.4	84	48	14	8	0.3	0.1	7	4	11.4	7.2	140	70	5	3.5	<10	<10
2001 Min	26	<3	3	<0.03	<0.03	0.4	0.2	82	39	8	4	0.2	<0.1	4	3	10.2	5.5	130	60	3.4	3.0	<10	<10
2001 Max	30	5	5	0.06	<0.03	0.7	1.0	88	56	27	19	0.4	0.2	10	6	12.9	10.7	150	80	6.2	4.1	<10	<10

Inf. Influent  
Eff. Effluent

Facilities (Ship Creek and Eklutna) during the Spring of 1991 caused a decrease in copper concentrations taken from "first draw" residential water sources in Anchorage. This increase in alkalinity was implemented to reduce corrosion in the drinking water distribution system. It would follow that these decreased values in drinking water would also affect the influent concentrations.

Total arsenic concentrations in the final effluent had remained fairly steady over the last five years, and 2001 values remained well within the range of those values seen before. The highest monthly maximum for total arsenic for the final effluent during the reporting period was 5 µg/L, compared to an MAEC of 4,882 µg/L (Table 21). Arsenic values are not a serious concern for this permit in terms of effluent concentrations, since the concentration in the final effluent is so much lower than the MAEC.

During 2001, less than 10 µg/L of cyanide was reported in the effluent during all the in-plant monitoring efforts (reported as <10 µg/L or <MDL), well below the MAEC of 143 µg/L. The concentrations of cyanide in the effluent were also reported as <10 µg/L during the June 2001 and September 2001 samplings. A cyanide level of 3.4 µg/L was seen in the effluent sample collected during the receiving water sampling. Cyanide had been a constituent of concern in past years because it approached or even exceeded the prior MAEC of 50 µg/L in some years. In 1986 it was observed that the effluent cyanide concentrations often exceeded the influent concentrations by an order of magnitude. This trend continued during subsequent years of sampling and was the subject of a special investigation conducted by the AWWU. The conclusion of this investigation was that the measured increase in cyanide between the influent and effluent was the result of the treatment plant's incinerator. Cyanide formed in the incinerator during sludge incineration is returned to the plant during the stack scrubbing process (CH2M Hill, 1987; CH2M Hill in association with Loren Leman, P.E., 1988). Subsequently, cyanide decreased and this was believed to be due to the change in the scrubbing water source from recirculated primary effluent to well water.

The most restrictive criteria of growth and propagation of fish, shellfish, other aquatic life, and wildlife was used for the hydrocarbon limits presented in Table 21. The MAECs for TAqH and total aromatic hydrocarbons as BETX were met this year, with maximum levels in the effluent well below the state-specified limits. The parameter of TAqH was analyzed in effluent only during the receiving water quality sampling, and the TAqH concentration was 13.04 µg/L as compared to the MAEC of 2,145 µg/L. The maximum BETX value of 11.0 µg/L was seen during the toxic pollutant and pesticide September 2001 sampling, and this value also fell well below the MAEC of 1,430 µg/L. The effluent sample collected in conjunction with the receiving water quality sampling event had a BETX concentration of 6.0 µg/L.

In addition to the MAECs based on the State and Federal water quality criteria, a number of other effluent limitations are specified in the NPDES permit. These daily, weekly, and monthly limitations include pH, TRC, BOD<sub>5</sub>, TSS, and fecal coliform (Table 21). All of these parameters except TRC were found to be within their permit limitations for 2001. The TRC daily maximum of 1.2 mg/L was exceeded once during the reporting period, on 6 December 2001; this exceedence was reported to EPA and ADEC in a letter dated 14 December 2001. The high daily average TRC resulted from adjustment of a newly-installed oxidation reduction potential chlorine feed control system. This system was installed to effectively meet permit limits while reducing chlorine usage, but increased TRC levels were seen during one day of the initial adjustment period.

For fecal coliform, the criterion of not more than 10 percent of the samples analyzed should exceed 2600 MPN/100 mL was met during the entire reporting period. It should be noted that the current permit actually includes a level that is 100 times higher (2600 FC MPN/**mL**), but this is believed to be a typographical error in the final permit. AWWU brought this to the attention of EPA in a letter dated November 8, 2000, but no permit modification has been made to date. In addition, the current permit limitation of a monthly geometric mean (of at least five samples) that shall not exceed 850 MPN/100 mL was not exceeded during the report period, with the maximum geometric mean never exceeding 119 MPN/100 mL. These limitations were in the original 1985 permit and remained unchanged in the 2000 permit.

The permit limitations for monthly and weekly averages and daily maxima were met for both BOD<sub>5</sub> and TSS. In addition, removal rates of at least 30 % were met for these two parameters as required under the amendments to the Clean Water Act (40 CFR; Final Rule, 8/9/94). Removal of BOD<sub>5</sub> averaged 42 % for the 2001 calendar year. Average removal rate of BOD<sub>5</sub> has decreased slightly over the last few years; this is suspected to be due to a greater percentage of soluble BOD<sub>5</sub> that cannot be removed by primary treatment processes. The average removal for TSS for this year was 81 %, about the same reported for the last five years and well above the requirement of 30 %.

Concentrations of other toxic pollutants and pesticides detected in the influent and final effluent were lower than or within the range of those detected in other POTWs from across the nation, even though the Asplund WPCF provides only primary treatment as compared to secondary treatment provided at the other plants (Table 22). They also generally fell within the historical range of values seen in past years; levels of toxic pollutants and pesticides detected in the Anchorage effluent this year and over the previous five years are shown in Table 23. These data indicate some variability over time, but a generally similar pattern overall. Levels are low and often below reporting limits. As in the past, the types and concentrations of measured organic compounds varied between the two sampling periods. This is probably the result of different point sources discharging into the Municipality's wastewater system at various times. Also, in some instances, large differences in pollutant concentrations occurred between the influent and effluent. Inconsistencies can be explained by looking at sampling methodology and plant operation in the case of point-source contaminants. If spikes of contaminants are occurring in the influent, these might be hit or missed during sampling. On the other hand, an effluent sample could contain the contaminant because of mixing in the clarifiers. Differences in concentrations in influent and effluent samples could also be due to lower suspended sediment and particulates in the effluent samples. This can be seen in Table 8, where greater variability usually occurs in the influent concentrations as compared to the effluent.

Historic discharge monitoring data (1986 - 2001) for other parameters of concern measured in the influent and effluent are presented in Table 25. Most parameters have remained fairly steady over time. Dissolved oxygen levels had been steadily increasing since 1986 but showed a peak in 1992, with generally decreased levels over most of the last eight years, including 2001. The cause of the changes in DO levels is unknown, however, previous changes in sampling location

**Table 25. Historical Discharge Monitoring Data (1986-Present) for Influent and Effluent Non-Metals.** Values represent average (Avg) or monthly minimum (Min) and maximum (Max) for 1996-1999 (program years running Nov. - Oct.) or a range of the results for years 1986-1995 as available. Results for 2000-2001 include Avg., Min. or Max. of 12 monthly values (Jan. - Dec.).

Year	Temperature (°C)		pH*		TRC (mg/L)		DO (mg/L)		BOD <sub>5</sub> (mg/L)		TSS (mg/L)		Fecal Coliform (FC/100 mL)	
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
1986-1995 Min	9	9	6.4	6.4	NA	0.6	NA	2.1	98	69	117	39	NA	5
1986-1995 Max	17	18	8.0	8.5	NA	1.0	NA	8.6	296	132	286	86	NA	726
1996 Avg	12	13	7.0-7.7	6.9-7.5	NA	0.8	NA	6.6	242	106	245	49	NA	31
1996 Min	10	10	NA	NA	NA	0.7	NA	6.1	206	86	214	44	NA	8
1996 Max	15	16	NA	NA	NA	0.9	NA	7.8	262	117	282	54	NA	106
1997 Avg	12	13	7.0-7.7	6.9-7.5	NA	0.9	NA	6.3	243	111	260	48	NA	60
1997 Min	10	10	NA	NA	NA	0.8	NA	5.8	225	99	228	43	NA	19
1997 Max	16	16	NA	NA	NA	0.9	NA	7.0	277	132	307	53	NA	179
1998 Avg	12	13	6.4-7.9	6.5-7.9	NA	0.8	NA	6.2	236	108	251	50	NA	23
1998 Min	10	11	NA	NA	NA	0.8	NA	5.6	184	91	204	44	NA	12
1998 Max	15	15	NA	NA	NA	0.9	NA	6.7	272	121	292	55	NA	44
1999 Avg	12.6	13.0	6.5-7.8	6.7-7.9	NA	0.8	NA	6.0	237	118	241	47	NA	71
1999 Min	10.3	10.5	NA	NA	NA	0.7	NA	4.8	203	102	217	41	NA	20
1999 Max	15.6	16.3	NA	NA	NA	0.9	NA	6.9	265	128	270	52	NA	201
2000 Avg	12.7	13.1	6.8-8.2	6.6-8.0	NA	0.8	NA	5.6	243	135	257	46	NA	83
2000 Min	10.4	10.8	NA	NA	NA	0.7	NA	4.5	209	124	220	39	NA	9
2000 Max	15.2	15.6	NA	NA	NA	0.8	NA	6.4	273	144	295	52	NA	252
2001 Avg	13.3	13.7	6.9-7.8 <sup>a</sup>	6.7-7.6 <sup>a</sup>	NA	0.8	NA	6.2	243	142	243	46	NA	39
2001 Min	11.1	11.5	NA	NA	NA	0.7	NA	5.2	225	125	223	37	NA	15
2001 Max	16.0	16.3	NA	NA	NA	0.8	NA	6.8	284	156	267	61	NA	119

\* Values represent yearly pH minimum and maximum

could account for some of the past increase. Other constituents of concern such as TSS have remained fairly steady in the effluent; influent TSS levels had increased during 1991 due to improved sampling methodology but have remained fairly steady since that time. The BOD<sub>5</sub> effluent average during 2001 (142 mg/L) was higher than that seen during prior years. However, BOD<sub>5</sub> levels in both the influent and effluent have shown a slight upward trend as a result of greater industrial contributors (e.g., fish processors) over the course of the program. The yearly average effluent fecal coliform bacteria concentration reported at 39 MPN/100 mL for 2001 was quite low but well within the range of that historically seen on the program.

***In summary, effluent monitoring indicated that, with the exception of a single incidence of elevated TRC, concentrations of toxic pollutants and pesticides, metals and cyanide, and conventional parameters were much lower than their applicable permit limits or their MAECs. TRC exceeded the permit daily maximum concentration limit once during December 2001, but the daily maximum was met for the remainder of the year. In addition, all toxic pollutants and pesticides concentrations (including metals and cyanide) were lower than or within the range of those detected at secondary treatment plants from across the nation.***

### **5.1.2 Sludge Monitoring**

The current permit requires sludge monitoring twice per year, once during the dry conditions in summer and once during wet conditions. However, there are no Part 503 monitoring requirements included in the reissued permit. Rather, the sludge monitoring is required because the Part 503 regulations are self-implementing as described in Section 2.1.5. Therefore, monitoring at the Asplund WPCF includes Part 503 monitoring of sludge. The Part 503 monitoring report for the year 2001 will be submitted to EPA as required by 19 February 2002.

While limits for levels of toxic pollutants and pesticides in sludge are not part of the current permit, comparisons can be made for these data based on other treatment facilities' monitoring results. Again, data indicate that concentrations of toxic pollutants and pesticides in Anchorage sludge are generally lower than "typical" concentrations seen at other treatment facilities (Table 26). Like last year, the arsenic concentrations seen in sludge were less than those typically seen, with an average of 3.1 µg/g from the Part 503 monitoring as compared to a typical concentration of 4.6 µg/g. June 2001 and September 2001 values also fell below the typical concentration for arsenic. The average mercury concentration in sludge for the 2001 reporting year was 1.1 µg/g, below the typical concentration of 1.49 µg/g. Mercury concentrations seen during the two priority pollutant sampling events were also below this typical concentration. Selenium monitoring is not a requirement of the Part 503 regulations, however, this pollutant is monitored during the Summer Dry and Summer Wet sampling events. The selenium value reported for the sludge sample during the September 2001 sampling event was 3.4 µg/g as compared to the typical concentration of 1.11 µg/g and a 95th percentile concentration of 4.848 µg/g for this metal. The June 2001 sampling showed a selenium concentration of 0.77 µg/g.

Table 27 provides an overview of historical sludge data for total metals and cyanide. In general, year 2001 data indicated slightly lowered concentrations of arsenic, cadmium, lead, and mercury compared to historical data. Values reported in 2001 for chromium and nickel were generally the same as those reported in the past. Beryllium values appeared slightly elevated again this year compared to historical averages. These values still fell well below the typical and 95th percentile concentrations reported for beryllium at 0.313 and 1.168 µg/g, respectively (Table 26).



**Table 26. Comparison Between Sludge Analysis Results for Anchorage and Typical and Worse Case Concentrations Used by EPA in Developing Median or Mean Environmental Profiles<sup>a</sup>. All concentrations are in  $\mu\text{g/g}$  dry weight.**

Pollutant	2001 Anchorage Values			Typical Concentration	95 <sup>th</sup> Percentile "Worse Case"
	June <sup>b</sup>	September <sup>b</sup>	2001 AVG <sup>c</sup>		
Aldrin/Dieldrin	ND(0.025)/ND(0.051)	ND(0.025)/ND(0.049)	---	0.07	0.81
Arsenic	2.9	4.0	NA	4.6	20.77
Benzene	ND(0.134)	ND(0.41)	---	0.326	6.58
Benzo(a)anthracene	ND(11.9)	ND(6.82)	---	0.68	4.8
Benzo(a)pyrene	ND(11.9)	ND(6.82)	---	0.14	1.94
Beryllium	0.12	0.189	NA	0.313	1.168
Bis(2-ethylhexyl)phthalate	40.0	27.7	---	94.28	459.25
Cadmium	2.0	2.4	NA	8.15	88.13
Carbon Tetrachloride	ND(0.134)	ND(0.207)	---	0.048	8.006
Chlordane ( $\alpha,\gamma$ )	ND(0.025)/ND(0.025)	ND(0.025)/ND(0.025)	---	3.2	12
Chloroform	ND(0.134)	ND(0.41)	---	0.049	1.177
Chromium	21.6	16.5	NA	230.1	1499.7
Copper	280	277	---	409.6	1427
Cyanide	ND(0.2)	ND(0.2)	---	476.2	2686.6
DDT/DDE/DDD	0.019/ND(0.0095)/ND(0.0095)	ND(0.0092)/ND(0.0092)/ND(0.0092)	---	0.28	0.93
3,3-Dichlorobenzidine	ND(11.9)	ND(6.82)	---	1.64	2.29
Methylene chloride	ND(0.134)	ND(0.207)	---	1.6	19
Endrin	ND(0.051)	ND(0.049)	---	0.14	0.17
Hexachlorobenzene	ND(11.9)	ND(6.82)	---	0.38	2.18
Hexachlorobutadiene	ND(11.9)	ND(6.82)	---	0.3	8
Lead	26.1	36.2	NA	248.2	1070.8
gamma -BHC (Lindane)	ND(0.025)	ND(0.025)	---	0.11	0.22
Malathion	ND(0.063)	ND(0.062)	---	0.045	0.63
Mercury	1.0	0.7	1.1	1.49	5.84
Nickel	15.3	15.0	NA	44.7	662.7
PCBs	ND(0.51)	ND(0.49)	---	0.99	2.9
Pentachlorophenol	ND(11.9)	ND(6.82)	---	0.0865	30.434
Phenanthrene	ND(11.9)	ND(6.82)	---	3.71	20.69
Phenol	ND(11.9)	ND(6.82)	---	4.884	82.06
Selenium	0.77	3.4	---	1.11	4.848
Tetrachloroethene	0.233	0.314 J	---	0.181	13.707
Trichloroethene	ND(0.134)	ND(0.207)	---	0.46	17.85
2,4,6-Trichlorophenol	ND(11.9)	ND(6.82)	---	2.3	4.6
Vinyl Chloride	ND(0.268)	ND(0.413)	---	0.43	311.942
Zinc	569	581	---	677.6	4580

<sup>a</sup> Source: EPA 1985c. *Summary of Environmental Profiles and Hazard Indices for Constituents of Municipal Sludge: Methods and Results*. Office of Water Regulations and Standards, Appendix F.

<sup>b</sup> Data from NPDES 2001 toxic pollutant and pesticide monitoring

<sup>c</sup> Average from 2001 Part 503 sludge monitoring results

--- Not monitored in-plant for Part 503

J Estimated value

NA Not available

ND ( ) Not detected (detection limit)

**Table 27. Historical Discharge Monitoring Data (1986 - Present) for Metals in Sludge.** Concentrations are in mg/kg dry weight. Values represent average (Avg.) or monthly minimum (Min) and maximum (Max) for 1996-1999 (program years running Nov. – Oct.) or a range of the results for years 1986-1995 as available. Results for 2000 include Avg., Min., or Max. of seven monthly values (Jan. - July) and Part 503 monitoring values if available (two or three results in Aug. - Dec. 2000). Results for 2001 represent Part 503 sludge monitoring values only.

Year	Arsenic	Beryllium*	Cadmium	Lead	Mercury	Nickel	Chromium (Total)
<b>1986-1995 Min</b>	1.7	<0.02	1.2	36	<0.1	<8	3.38
<b>1986-1995 Max</b>	151	0.20	10.0	468	7.3	42	38
1996 Avg	11.2	0.12	3.6	62	1.7	18	27
1996 Min	5.2	0.07	2.4	49	0.8	15	20
1996 Max	31.7	0.22	4.7	104	3.3	26	48
1997 Avg	9.4	0.11	3.7	60	1.4	22	21
1997 Min	5.0	<0.02	1.4	32	0.2	14	13
1997 Max	20.4	0.19	5.1	80	2.8	27	26
1998 Avg	18.0	0.10	3.0	70	1.5	18	20
1998 Min	3.6	0.07	0.7	33	0.7	11	5
1998 Max	135.8	0.14	5.2	294	2.9	26	55
1999 Avg	9.1	0.11	2.9	46	1.9	20	21
1999 Min	2.2	0.02	1.1	32	0.9	10	12
1999 Max	36.1	0.18	5.2	88	4.0	28	28
2000 Avg	3.6	0.13	2.5	37	1.6	21	22
2000 Min	2.1	0.09	1.8	24	0.8	12	12
2000 Max	4.8	0.19	3.2	53	3.2	27	49
2001 Avg	3.1	0.15	2.6	43	1.1	17	17
2001 Min	2.4	0.12	2.0	26	0.5	15	12
2001 Max	4.0	0.21	3.4	91	2.0	19	22

\* Beryllium testing began in 1993

## **5.2 WATER QUALITY MONITORING**

### **5.2.1 Plume Dispersion Sampling**

To test the hypothesis that the water quality at the ZID boundary was not degraded with respect to the water quality at the nearfield and control stations, the non-parametric Kruskal-Wallis Test (Zar, 1984) was employed which determined whether significant differences occurred within the sample group. If significant differences were observed, Dunn's test, a test that performs pair-wise tests of significance ( $\alpha = 0.05$ ), was employed (Dunn, 1964). The results of these tests for the June survey period as a function of water quality parameters are presented in Table 28. Non-detect values were replaced with the detection limit value for statistical testing.

Data from the receiving water survey showed statistically significant difference between outfall and control stations for temperature, salinity, pH, and turbidity at some of the depths. Temperature was found to have significant differences between the control and each outfall group for all depths which was the result of the control location being warmer than the outfall location and was not related to the outfall discharge. Similarly, salinity was found to be significantly different between the control and some of the outfall groupings for the middle and bottom depths. This difference was the result of the control stations being fresher as a result of increased river influence on the north side of Knik Arm. Although not seen in last year's data, this pattern of warmer, less saline water at the control site has been seen numerous years in the past. Statistical analyses indicated significant differences between some station groups at surface and middle depths for pH. Review of the data show that the pH at the control stations were slightly lower than those at the outfall stations. The pH values fell within the AWQS of 6.5 - 8.5 and did not vary more than 0.2 pH units. It is likely that, as in the past, very small differences in pH can be attributed to the natural variability in the two water masses being sampled. Turbidity was found to be significantly different between the control site and the within-ZID outfall station at the bottom; this was the result of much higher turbidity at the control site.

No statistically significant differences were noted between outfall and control stations in terms of color or TRC results. These parameters are only tested at the surface and were similar across most stations.

In addition to the standard water quality sampling, concentrations of total aromatic hydrocarbons as BETX and TAqH were measured at the surface at six stations (three at the flood tide control site and three at the flood tide outfall site). Concentrations of BETX were found to be below detection limits at all stations, therefore no significant differences were found between the control and outfall station groups for any of these parameters. No significant differences were seen in concentrations of TAqH, which is the sum of total polycyclic aromatic hydrocarbons and BETX, between the outfall and control locations.

Total suspended solids and total recoverable and dissolved metals samples collected at the outfall and control sites were also subject to statistical testing. No significant differences between locations were noted for TSS or any total recoverable metals. Total silver appeared to be

**Table 28. Significant Station Pairs at the 5% Significance Level Using the Kruskal-Wallis and Dunn's Tests.**

Parameter	Sample Depth		
	Surface	Middle	Bottom
Temperature*	1,4 / 2,4 / 3,4	1,4 / 2,4 / 3,4	1,4 / 3,4
Salinity*	NS	2,4	1,4 / 2,4 / 3,4
Dissolved Oxygen*	NS	NS	NS
pH*	2,4	1,4 / 3,4	NS
Turbidity*	NS	NS	1,4
Color Units*	NS	----	----
Fecal Coliform*	NS	----	----
Total Residual Chlorine*	NS	----	----
Arsenic**	NS <sup>D</sup> ,NS <sup>TR</sup>	----	----
Cadmium**	<b>SIG</b> <sup>D</sup> ,NS <sup>TR</sup>	----	----
Chromium**	NS <sup>D</sup> ,NS <sup>TR</sup>	----	----
Copper**	<b>SIG</b> <sup>D</sup> ,NS <sup>TR</sup>	----	----
Mercury**	NS <sup>D</sup> ,NS <sup>TR</sup>	----	----
Nickel**	NS <sup>D</sup> ,NS <sup>TR</sup>	----	----
Lead**	<b>SIG</b> <sup>D</sup> ,NS <sup>TR</sup>	----	----
Silver**	<b>SIG</b> <sup>D</sup> ,NS <sup>TR</sup>	----	----
Zinc**	NS <sup>D</sup> ,NS <sup>TR</sup>	----	----
Cyanide**	NS	----	----
Total Suspended Solids**	NS	----	----
Total Aromatic Hydrocarbons (BETX)**	NS	----	----
Total Aqueous Hydrocarbons (TAqH)**	NS	----	----

\* Statistics performed on Group 1: Within-ZID Stations; Group 2: ZID Boundary Stations; Group 3: Nearfield Stations; and Group 4: Control Stations.

\*\* Statistics performed on stations along outfall Drogue F1 versus the control, Drogue C1.

---- Not Applicable (surface samples only)

NS Not Significant

SIG Significant

<sup>D</sup> Dissolved

<sup>TR</sup> Total Recoverable

elevated at the outfall, Station F1-1, however differences were not found to be significant. Most other total metals were actually higher in the receiving water compared to the effluent discharge.

For dissolved metals, statistically significant differences were seen for cadmium, copper, lead, and silver that were the result of the outfall stations being higher in these parameters. For total cadmium, copper, and silver, concentrations were highest at Station F1-1 which appeared to be due to influence of the outfall discharge as evidenced by the higher concentrations seen in the effluent versus the receiving water concentrations. Dissolved lead was found to be highest at Station F1-3; its source was not known.

A comparison of the water quality data listed in Table 15 with the marine receiving water quality for the State of Alaska (Table 21 and Table 29) indicates that with the exception of color, none of the parameters listed in Table 15 exceeded the State's standards. Most color values were at or below the state-specified limit of 15 color units, but 20 color units was seen once at each of four stations, twice within the ZID (Stations E1-1 and E3-1), once on the ZID boundary (Station F1-2), and once at a nearfield station located over a mile from the outfall (Station E2-4). Given that this exceedence occurred at a far-removed site as well as the outfall stations, it is unlikely that the increased color values are ascribable to the outfall. It is more likely that these elevated values are a turbidity issue. Last year, 20 color units were also seen at the control location.

The State's receiving water quality standard for the "growth and propagation of fish, shellfish, aquatic life, and wildlife including seabirds, waterfowl, and furbearers" is 15 µg/L for TAqH and 10 µg/L for total aromatic hydrocarbons as BETX. As seen in Table 17, these standards were met. For both the control and outfall stations, BETX was reported as not detected, with method detection limits well below the state standards, and TAqH values were very low. In addition, for "contact recreation", the AWQS for hydrocarbons is as follows: "Shall not cause a film, sheen, or discoloration on the surface or floor of the water body or adjoining shorelines. Surface waters shall be virtually free from floating oils." No film, sheen, or discoloration was observed during the receiving water program in 2001.

All the dissolved metals tested in receiving water (Table 16) as part of this program met the AWQS criteria as shown in Table 21. This included arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc. Testing of antimony, beryllium, selenium, and thallium in receiving water is not required by the permit and was not performed this year. Previous years of the monitoring program showed exceedences of water quality criteria for total metals that were due to the specified test methods in conjunction with high amounts of suspended particulates in Cook Inlet. Since the adoption of the more-appropriate SSWQC for dissolved metals in May 1999, the receiving waters of Cook Inlet near the Asplund WPCF discharge have been in compliance with the AWQS.

Cyanide samples collected during the receiving water sampling were all below the detection limit of 2 µg/L. Cyanide levels therefore met the State-specified criteria of 2 µg/L which is the water quality standard for marine aquatic life. Cyanide concentration in the effluent was 3.4 µg/L, well below the MAEC of 143 µg/L.

***In summation, statistical analyses of the 2001 receiving water quality data indicated that water quality outside the ZID was not degraded with respect to control stations for most parameters. Differences that were noted in some parameters such as temperature, salinity, and pH were***

**Table 29. State of Alaska Water Quality Standards for Receiving Water.**

Parameter	Most Restrictive Marine Water Quality Standards								
Fecal Coliform	Based on a 5-tube decimal dilution test the fecal coliform median MPN shall not exceed 14 FC/100 mL (harvesting for consumption of raw shellfish); a geometric mean of 20 FC/100 mL (for aquaculture of products not normally cooked and seafood processing); and not more than ten percent (10%) of the samples shall exceed 40 FC/100 mL (aquaculture of products not normally cooked and seafood processing).								
Dissolved Oxygen	Dissolved oxygen concentrations in estuaries and tidal tributaries shall not be less than 5.0 mg/L except where natural conditions cause this value to be depressed.								
pH	pH shall not be less than 6.5 or greater than 8.5, and shall not vary more than 0.2 pH unit from natural condition.								
Turbidity	Turbidity may not exceed the natural condition.								
Temperature	Temperature shall not cause the weekly average temperature to increase more than 1° C. The maximum rate of change shall not exceed 0.5° C per hour. Normal daily temperature cycles shall not be altered in amplitude or frequency.								
Salinity	Maximum allowable variation above natural salinity: <table> <tr> <th>Natural Salinity (‰)</th><th>Man-induced Salinity (‰)</th></tr> <tr> <td>0 to 3.5</td><td>1</td></tr> <tr> <td>3.5 to 13.5</td><td>2</td></tr> <tr> <td>13.5 to 35.0</td><td>4</td></tr> </table>	Natural Salinity (‰)	Man-induced Salinity (‰)	0 to 3.5	1	3.5 to 13.5	2	13.5 to 35.0	4
Natural Salinity (‰)	Man-induced Salinity (‰)								
0 to 3.5	1								
3.5 to 13.5	2								
13.5 to 35.0	4								
Sediment	No measurable increase in concentrations above natural conditions.								
Color	Color shall not exceed 15 color units.								
Petroleum Hydrocarbons, Oils and Grease	Total aqueous hydrocarbons (TAQH) in the water column shall not exceed 15 µg/L. Total aromatic hydrocarbons in the water column shall not exceed 10 µg/L. Shall not cause a film, sheen, or discoloration on the surface or floor of the water body or adjoining shorelines. Surface waters shall be virtually free from floating oils.								
Total Residual Chlorine	Concentrations shall not exceed 2.0 µg/L for salmonid fish or 10.0 µg/L for other organisms.								
Toxic and Other Deleterious Substances	See Table 21.								

*unlikely to be influenced by the Asplund WPCF outfall. With the exception of color, all AWQS were met for the Asplund WPCF receiving water quality program. Elevated color values were seen at some outfall stations but this was not attributed to the outfall. All metals and hydrocarbon concentrations were well within AWQS. No significant differences were seen for total metals and hydrocarbon concentrations between the outfall and control locations. Significant differences in dissolved cadmium, copper, and silver were seen that were attributed to the outfall, however all concentrations were well below the AWQS.*

### **5.2.2 Fecal Coliform Bacteria**

The ADEC has indicated that one of their primary concerns is bacterial contamination of the shoreline by the Point Woronzof discharge, indicated by fecal coliform bacteria concentrations. Because the Knik Arm's water uses have not been classified, regulations provide that the most restrictive standard must apply. State marine water quality standards for contact recreation require that the geometric mean fecal coliform concentration taken within a 30-day period not exceed 100 MPN/100 mL and that not more than one sample or more than ten percent of the samples if there are more than ten exceed 200 MPN/100 mL. Criteria for secondary recreation and for industrial water supply require that the mean fecal coliform concentration not exceed 200 MPN/100 mL and that not more than ten percent of the samples exceed 400 MPN/100 mL. State marine water quality criteria for the harvesting for consumption of raw mollusks and other raw aquatic life require that, based on a 5-tube decimal dilution test, the median shall not exceed 14 MPN/100 mL and that not more than ten percent of the samples shall exceed 43 MPN/100 mL. For seafood processing water supply for products not normally cooked, criteria are that the geometric mean may not exceed 20 MPN/100 mL and not more than ten percent of the samples exceed 40 MPN/100 mL, and 200 and 400 MPN/100 mL for products normally cooked, respectively. For aquaculture water supply, criteria are that the geometric mean may not exceed 20 MPN/100 mL and not more than ten percent of the samples exceed 40 MPN/100 mL.

Since the harvesting of shellfish and other raw aquatic life is not performed in these waters and there is no aquaculture or seafood processing, it seems that the criteria for secondary recreation is most applicable; however, these criteria are not the most restrictive. Therefore, the most restrictive criteria used were that the median shall not exceed 14 MPN/100 mL (consumption of raw shellfish and other aquatic life), the geometric mean shall not exceed 20 MPN/100 mL (seafood processing and aquaculture for raw consumption), and not more than ten percent shall exceed 40 MPN/100 mL (seafood processing and aquaculture for raw consumption; Table 29).

Statistical tests indicated that fecal coliform concentrations were not significantly different between the within-ZID, ZID boundary, and the nearfield station groups as compared to the control stations (refer to Table 28). Fecal coliform concentrations values ranged from <2.0 to 13.0 MPN/100 mL at the outfall stations compared to range of <2.0 to 4.0 MPN/100 mL at the control stations. The median at both the control site and outfall stations was 2.0 MPN/100 mL. The control site had a geometric mean of 2.2 MPN/100 mL, while that at the outfall stations was 2.5 MPN/100 mL, again well below the criteria of 20 MPN/100 mL. Zero out of 24 measurements at the outfall stations exceeded 40 MPN/100 mL, compared to the criteria of not more than 10 percent of the measurements may exceed 40 MPN/100 mL.

As in the past, high fecal coliform bacterial concentrations were seen in the two of the three creeks sampled. Replicate concentrations measured in Chester Creek were 2.0 and 2.0 MPN/100

mL, in Fish Creek were 220 and 130 MPN/100 mL, and in Ship Creek were 50 and 70 MPN/100 mL.

The range of fecal coliform concentrations for all intertidal samples collected during 2001 was <2.0 to 50.0 MPN/100 mL, with a median of 2.0 MPN/100 mL and a geometric mean of 4.8 MPN/100 mL. This is compared to the most restrictive water quality criterion of a median of 14 MPN/100 mL and a geometric mean of 20 MPN/100 mL. The four highest coliform concentrations were seen at Stations IT-4 and IT-5 which are located within 250 m of the outfall and may indicate an outfall related impact. The criterion of not more than 10 % of the samples exceeding 40 FC 100/mL was not met, as 2 out of 16 intertidal measurements (12.5 %) exceeded this value. Some of these slightly elevated intertidal concentrations, however, may be the result of heavy waterfowl use of the area, since concentrations measured over the outfall and in the effluent during the same time period were relatively low. Fecal coliform concentrations in the effluent samples collected in conjunction with the receiving water, intertidal station, and stream sampling was reported at 2.0 MPN/100 mL for both replicates.

*In summary, no elevated fecal coliform concentrations in the Point Woronzof area were seen during the offshore receiving water sampling for either the outfall or control stations, and no statistically significant difference was seen between station groupings for within the mixing zone, ZID-boundary, or nearfield stations as compared to the control location. Area creeks again showed the highest fecal coliform concentrations compared to the intertidal or receiving water stations, indicating that receiving water concentrations may be influenced by runoff from these creeks. Fecal coliform samples collected during the receiving water sampling program met the most restrictive receiving water standards. However, some elevated fecal coliform samples that exceeded one of the water quality criteria were seen during the intertidal sampling. These elevated values may have been due to either the outfall or heavy waterfowl use and/or stream influence on the intertidal area as concentrations measured offshore and in the effluent at the same time were very low.*





## 6.0 CONCLUSIONS

The following conclusions were based on results from this year of monitoring as compared to the current NPDES permit:

- The influent, effluent, and sludge monitoring has shown that, with the exception of only a single incident involving TRC, the Asplund WPCF met the NPDES permit requirements and complied with State of Alaska water quality standards. MOA's self-monitoring of pH, BOD<sub>5</sub>, TSS, and fecal coliform showed compliance with all 2001 permit effluent limitations.
- MOA's self-monitoring of TRC showed that the daily maximum for TRC in the effluent was exceeded once in December 2001 during the installation of a new chlorine feed control system; this exceedence is not expected to re-occur once this system is fully implemented. Daily maximum permit limitations for this parameter were met during the remainder of the year.
- Percent removals for BOD<sub>5</sub> (42 %) and TSS (81 %) were considerably better than the 30 % required by the amendment to the Clean Water Act (40 CFR Part 125; Final Rule, 8/9/94).
- Total aqueous hydrocarbon and total aromatic hydrocarbon concentrations in the effluent were below their respective MAECs.
- Cyanide and metals concentrations in the effluent never exceeded their MAECs during any of the sampling events.
- Concentrations of toxic pollutants and pesticides, including metals and cyanide, in influent and effluent were within the established range or lower than values from a national study of secondary treatment plants. Toxic pollutant sludge concentrations were within the established range or lower than values from a national study of secondary treatment plants.
- Whole effluent toxicity testing conducted quarterly during 2001 met the permit limitations for chronic toxicity.
- To test the hypothesis that the water quality at the ZID boundary was not degraded with respect to the water quality at the nearfield and control stations, statistical comparisons were employed. Conventional parameters such as temperature, salinity, pH, and turbidity did show statistically significant differences between stations, but these were not ascribed to the outfall. Rather, these have historically been seen when comparing the Pt. Woronzof region to the warmer, less saline waters across Knik Arm at the control site. No significant differences were seen for dissolved oxygen, fecal coliform, or total residual chlorine.
- Fecal coliform concentrations in receiving water samples met the State-specified criteria of a median of 14 MPN/100 mL, a geometric mean of 20 MPN/100 mL, and of not more than 10 % of the samples exceeding 40 MPN/100 mL. Fecal coliform concentrations in intertidal samples met the median and geometric mean criteria, but more than 10 % of the

samples collected exceeded 40 MPN/100 mL. It was inconclusive whether these concentrations were due to the effluent discharge, since concentrations measured at the outfall and in the effluent during the same time period were found to be low.

- Supplemental receiving water quality samples obtained as part of the plume dispersion monitoring indicated that background levels of dissolved metals were all below the State site-specific water quality standards. Total recoverable metals were elevated compared to the dissolved, as expected, and this was attributed to high suspended sediment loads. No significant differences between the outfall and control stations were found for any total recoverable metals or most of the dissolved metals. Significant differences were seen in dissolved cadmium, copper, lead, and silver and with the exception of lead these were ascribed to the outfall.
- All cyanide concentrations in receiving waters were below detection limits; these concentrations met State water quality criteria.
- Supplemental receiving water samples also indicated that total aromatic hydrocarbons and total aqueous hydrocarbons did not exceed the State's water quality standard at any outfall or control station. Concentrations were all below detection limits, and no significant differences were found between concentrations at the control and outfall stations.
- Turbidity and total residual chlorine met the State water quality criteria at all stations. Color exceeded the State water quality criterion at a number of stations, as has been seen in the past, and this was not attributed to the outfall.

## CONCLUSIONS

Results from this year of the monitoring program confirm previous studies, data in the 301(h) waiver application, and the decision by the EPA to reissue the permit. The Asplund WPCF is operating within regulatory requirements with no significant impacts to the marine environment.

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